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User Manual of CellBOX- H Recorder and HydraNT Communication Software.

December 2004

The producer reserves the right to introduce modifications without warning.

Dear Customers,

- We are giving you a product fulfilling high quality requirements, equalling to the world standards.

- The products we offer are in accordance with the EU directives and are provided with CE mark.

- The producer reserves the right to modify the construction and internal software of CellBOX-H recorder, aiming at improving its technical-operational properties.

- We presume that our product is going to fulfill your expectations. However, it is crucial to get acquainted with this operating and service instruction as well as to use the product according to the guidelines given.

- This instruction contains basic information about CellBOX-H recorder; in case further technical information is needed, you should contact the producer – BIATEL S.A. Joint – Stock Company.

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1. Introduction.

This document is a functional description of CellBOX-H recorder. It contains information on the procedures of installation and operation of version v1.4 (version in a metal case adjusted to installation in CellBOX-H Hydrant hydrant boxes and in CellBOX-H BOX plastic case) and BIATEL HydraNT software version 1.2.

The instruction manual and health and safety rules must be strictly obeyed when installing and dismantling CellBOX-H recorder.

2. Technical Description.

2.1 Purpose

The device is a microprocessor programable recorder, designed for measurement of water-pipe networks parameters with the option of simultaneous displaying and transmission of data to the master system. It enables the real time measurement and recording of pressure, temperature, any three physical quantities converted into a standard electrical signal of 4-20mA and the states of the three digital inputs. In a metal case, it is adjusted directly to operating in underground hydrant boxes. With application of an appropriate terminal adjusting CellBOX-H Hydrant terminal socket, the device can operate in other locations outside a hydrant box. CellBOX-H BOX plastic case version is adjusted to mounting in instrumentation boxes and also operating as an independent recorder.

Due to its compact construction, being equipped with a set of internal batteries, non-volatile internal FLASH memory and built-in pressure (metal case version) and temperature converters, it performs measurements and recordings autonomically.

For the version of the recorder that is optionally provided with GSM/GPRS modem, not only transfer of local data recording but also automatic transfer of measurement results to a central office (e.g. a control room) is possible.

2.2 Technical data.

2.2.1 CellBOX-H Hydrant – metal case version.

2.2.1.1. Power supply

Supply voltage:

a) internal – unattended battery pack BPACK-1.4 BIATEL; battery life of 5 years with measurments recorded in 15 min. intervals and without GSM module operation.
b) external – 15...28 V DC; when working with a GSM/GPRS modem, the power supply unit should be adjusted to single-phase power load of about 10 W.

2.2.1.2. Interfaces

- RS232 interface;
- External power supply;
- Connector for analog inputs and digital inputs;
- Special version of GSM antena connector (GSM/GPRS option);
- 16-digit LCD display;

2.2.1.3. Analog inputs

5 galvanically non-isolated inputs of 12-bit resolution with a digital filter eliminating disturbances of 50 Hz energy network:

a) measurement of pressure:
   - range 0...16 bar;
   - maximum short-term overload 32 bar;
   - accuracy 0,5%;
b) measurement of temperature:
   - range –25...70ºC;
   - accuracy ±2ºC;
c) 3 universal inputs – standard version:
   - current input with range of 4...20 mA;
   - input resistance 100 Ω;
   - accuracy 0,1%;
   - option of a different configuration according to the order – special version;

2.2.1.4. Digital inputs

6 digital inputs:

a) sensor of hydrant box lid opening;
b) external power supply detector;
c) detector of RS232 port activity;

d) 3 configured inputs – universal with common ground, adjusted to cooperation with "OC" or "mechanical connector" type systems; average time of reaction 10 ms;
   - event type (e.g. event duration interval of 1 s);
   - counter type (e.g. cooperation with a water meter equipped with an impulse transmitter, fmax = 100 Hz);

2.2.1.5. Measurements recording

- Non-volatile internal FLASH memory enabling the recording of 15,360 records with measurements in a round cycle (i.e. after the memory is full, new records are entered again from the beginning of FLASH memory), possibility of expanding the memory x 2.

- 1 record – measurements showing the actual recorder state (pressure, temperature, states of analog inputs, battery state, counters, events: opening of the hydrant box lid, presence of external power supply, RS232 active port, change of digital inputs state);

- recording of data with time interval from 1s to 31 days with resolution of 1s;

2.2.1.6. Additional functions

- Internal real time clock;

- Control of internal battery packs discharge state;

- Non-contact (optical) sensor of hydrant box lid opening;

- Reading of recorder memory contents from a portable computer without terminating the recording process;

- Possibility of GSM/GPRS event type transmission after exceeding the fixed values (alert thresholds) on digital as well as analog inputs;

2.2.1.7. Conditions of operation

- Temperature of environment:
  a) Recorder without GSM modem: -25...+70°C;
  b) Recorder with active GSM modem: -20...+55°C;
  Caution: for pressure measurement using the internal converter, the range of operation is 0...+70°C (freezing of water in the internal pressure converter is unacceptable);
- Temperature of storage: -40...+85°C;

2.2.1.8. Version

- Metal case adjusted to direct installation in an underground hydrant box;
- Overall dimensions: max. height 150 mm; max. diameter 110 mm, mass about 2.10 kg;
- Version IP68;

2.2.1.9. Alarm thresholds

Software implemented by CellBOX-H enables defining alert thresholds on digital as well as analog inputs. An alert situation, i.e. exceeding a properly defined alert threshold will effect in changing the runtime mode of GPRS module of the device, from "sleep" mode into active mode and sending alert signalization to the target place defined by the user.

2.2.2 CellBOX-H BOX – plastic case version

2.2.2.1. Power supply

Supply voltage:

c) internal – unattended battery pack BPACK-2.1 BIATEL; battery life of 5 years with measurments recorded in 15 min. intervals and without GSM module operation;
d) external – 15...28 V DC; when working with GSM/GPRS modem, the power supply unit should be adjusted to single-phase power load of about 10 W.

2.2.2.2. User's interfaces

- RS232 interface;
- External power supply;
- Connector for analog inputs and digital inputs;
- Special version of GSM antena connector (GSM/GPRS option);
- 16-digit LCD display;
- Button;

2.2.2.3. Analog inputs

5 galvanically non-isolated inputs of 12-bit resolution with a digital filter eliminating disturbances of 50 Hz energy network:

a) measurement of temperature:
   - range -25... 70°C;
   - accuracy ±2ºC;
b) 3 universal inputs – standard version:
   - current input with range of 4...20 mA;
   - input resistance 100 Ω;
   - accuracy 0,1%;
   - option of a different configuration according to the order – special version;
c) universal inputs – redefined to pressure measurement from the external converter – standard version:
   - current input with range of 4...20 mA;
   - input resistance 100 Ω;
   - accuracy 0,1%;
   - measurement range 0...16 bar;
   - option of a different configuration according to the order – special version;

2.2.2.4. Digital inputs

5 digital inputs:

a) external power supply detector;
b) RS232 port activity detector;
c) 3 configured inputs – universal with common mass, adjusted to cooperation with "OC" or "mechanical connector" type systems; average time of reaction 10 ms;
   - event type (e.g. event duration interval of 1 s);
   - counter type (e.g. cooperation with a water meter equipped with impulse transmitter, fmax = 100 Hz);

2.2.2.5. Measurements recording

- Non-volatile internal FLASH memory enabling the recording of 15,360 records with measurements in a round cycle (i.e. after the memory is full, new records are placed again from the beginning of FLASH memory), possibility of expanding the memory x 2.

- 1 record – measurements showing the actual recorder state (pressure, temperature, analog input states, battery state, counters, events: opening of the hydrant box lid, external power supply presence, RS232 active port, change of digital inputs state);

- recording of data with time interval from 1s to 31 days with resolution of 1s;

2.2.2.6. Additional functions

- Internal real time clock;

- Control of internal battery packs discharge state;

- Button for LCD display activation and changing successive messages;

- Reading of recorder memory contents from a portable computer without terminating the recording process;

- Possibility of defining alarm thresholds on digital as well as analog inputs;

2.2.2.7. Conditions of operation

- Temperature of environment:
  a) Recorder without GSM modem: -25...+70°C;
  b) Recorder with active GSM modem: -20...+55°C;

- Temperature of storage: -40...+85°C;

2.2.2.8. Version

- Plastic case;
- Overall dimensions: max. height 61 mm; max. diameter 131 mm, max. depth 130 mm;
- Mass about 1 kg;;
- Version IP65 (for mounting in a telemetry box) or IP67 (for mounting directly in a measurement chamber);

2.2.3 GSM module (GSM/GPRS option)

- Dual Band EGSM 900 and GSM1800 (GSM Phase 2+)
- Transmission: GPRS;
- GPRS multi-slot class 4, GPRS data downlink transfer: max. 39 kbps, GPRS data uplink transfer: max. 13 kbps;
- Rx sensitivity: -106.5dBm (E-GSM 900); -105.5dBm (GSM 1800);
- Power consumption: Class 4 (2W) for EGSM900, Class 1 (1W) for GSM1800;
- SIM card 3V (small size GSM version);
- External antenna with impedance of 50Ω required;
- The recorder has a SIM Holder type SIM card socket and accepts 3V SIM cards;

2.2.4 Software

- ✓ Ability of operating in SCADA TelWIN systems – cellhdrv.exe communication driver available.
- ✓ Basic software for reading and configuring the recorder: Biatel HydraNT version 1.2 application (useware in Polish) enabling:
  - presentation of the data read in the form of a diagram;
  - configuration of the recorder via the RS232 local port or remotely via GPRS network (optional);
  - data export to Microsoft Excel or a text file;
  - data import from Microsoft Excel or a text file (archive files);
  - archivization of data;

- possibility of transferring files between computers;
- minimal system requirements: operating system: Microsoft Windows NT, Windows 9x, 1000, or XP, Pentium class PC, 24 MB RAM, 10 MB of free HDD space, CD-ROM;
- option of a different configuration according to the user for individual orders (special version)

2.3 Basic instructions for proper operation.

For proper operation of the recorder, the following instructions must be strictly obeyed:

- Do not expose the device to fire;
- Dismantling of the electronics module is forbiden as it may lead to damage and loss of warranty (the recorder has a built-in "intelligent warranty seal" recording each opening of the electronics module);
- Conditions of operation given in this instruction must be strictly obeyed (environmental conditions, power supply conditions, electrical parameters of communication interfaces, mechanical parameters, etc.);

2.3.1. Information concerning safety of operation of the device with GSM/GPRS transmission – general instruction.

2.3.1.1 Installation.

Installation, aerial installation, connections, etc. should be made by persons experienced in working with elecronical or radio devices (e.g. GSM).

2.3.1.2 Localization.

When selecting a site of operation of the recorder with GSM/GPRS module, regulations and markings in force in the area must be obeyed. Using it in

places where usage of GSM or devices emitting radio frequency waves (due to possible radio or other disturbance) is not allowed.

2.3.1.3 External devices.

Before installing the recorder with GSM/GPRS active modem, make sure if the external devices are not susceptible to signals of radio frequency (900/1800 MHz – GSM range of operation), which could disturb their functioning.

2.3.1.4 Heart stimulators.

It is recommended that the distance between the external antenna of the recorder and the GSM/GPRS active modem was greater than 20 cm. This is the minimal distance recommended by producers of these devices protecting the stimulator from potential disturbances.

2.3.1.5 Hearing aids and other medical apparatuses.

Sometimes the signal emitted by the external antenna of the recorder with the GSM/GPRS active modem (GSM device) can cause disturbances in hearing aids and electronic medical apparatuses functioning. In case of noticing such disturbances, acquaint with detailed the producer's operating instructions of the hearing aid; in the case of medical apparatuses, contact with the producer immediately in order to make sure whether the apparatus in question has been properly protected against harmful influence of radio frequency waves (GSM range).

2.3.1.6 Explosion hazard areas.

It is not allowed to install the recorder with the active GSM/GPRS modem in places, wher the physical-chemical conditions can couse an explosion. In case of lack of marking , the device should not be installed in explosion hazard

areas, in places of liquid and gas fuels storage, combustible materials storage, places dirtied by metal dust or cereal plants grain dust.

3. Installation instruction.

3.1 Packet contents

- CD with software – 1 piece
- Installation and operating instr. – 1 piece
- CellBOX-H recorder, a set with internal battery pack – 1 piece
- Antenna cable, special version, length 2 m (opt. for GSM/GPRS) – 1 piece
- External accumulators pack (option for GSM/GPRS) – 1 piece

For the metal case version:

- RS232 communication cable v. 1.40 – standard length 2 m – 1 piece
- AI/DI signal cable – standard length 2 m – 1 piece

For the plastic case version:

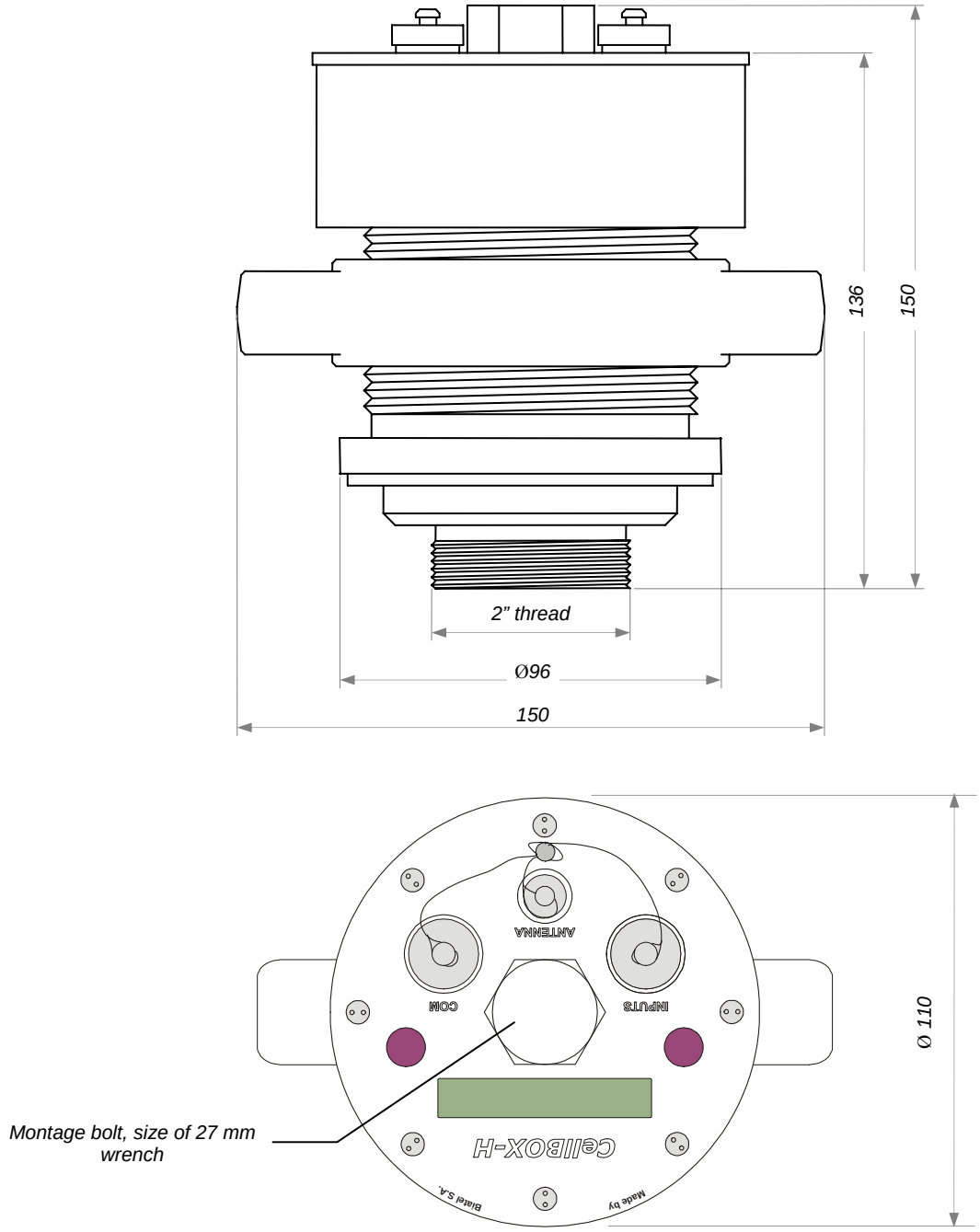
- RS232 communication cable v. 1.40 – standard length 2 m – 1 piece
- AI/DI signal cable – standard length 2 m – 1 piece
- AI/Power signal cable – standard length 2 m – 1 piece

For individual orders, the real number and length of cables as well as packet contents may be different from the one given above.

More additional accessories are available, see pt. 6

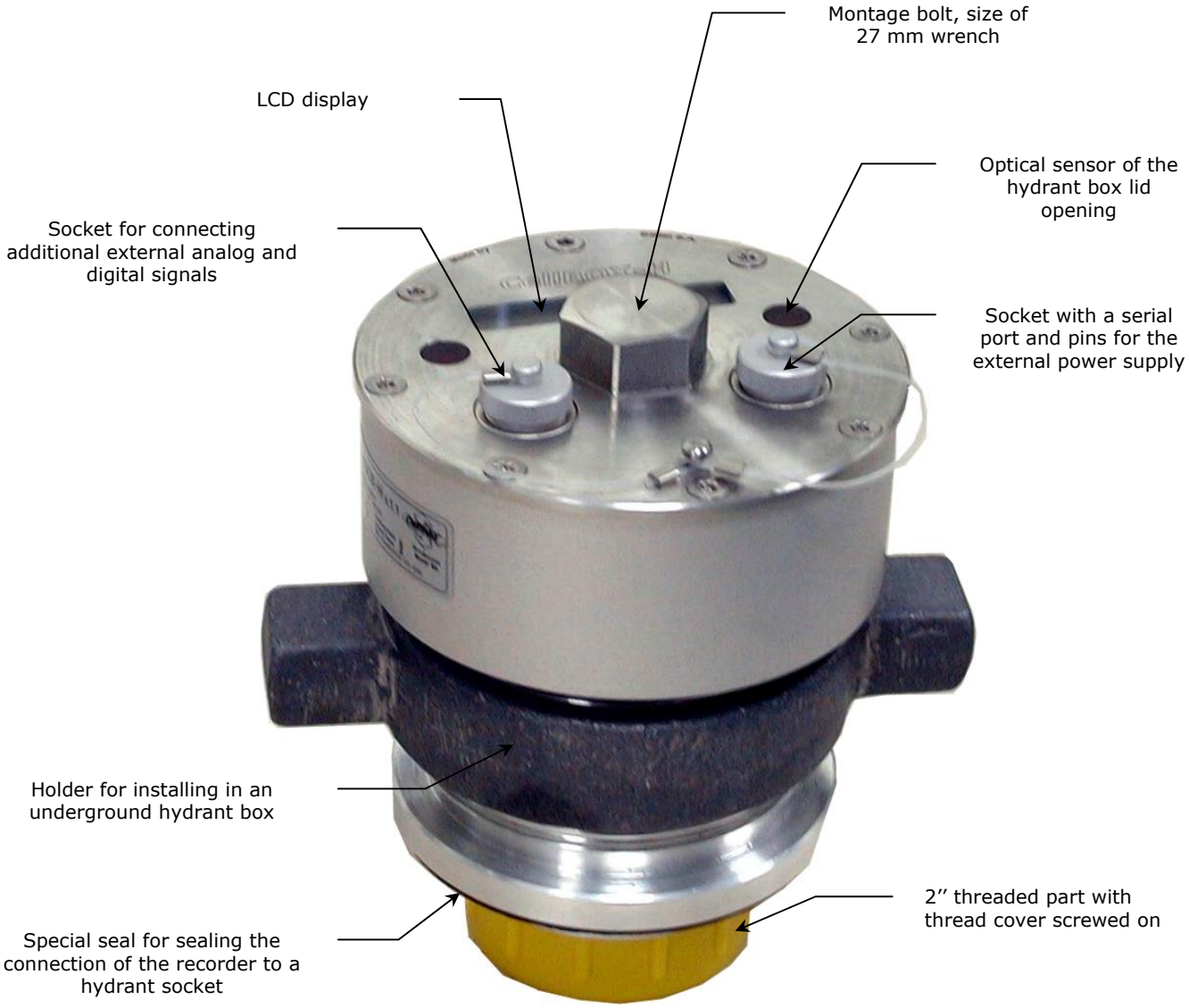
3.2 Recorder in a metal case – CellBOX-H Hydrant

3.2.1 Overall dimensions



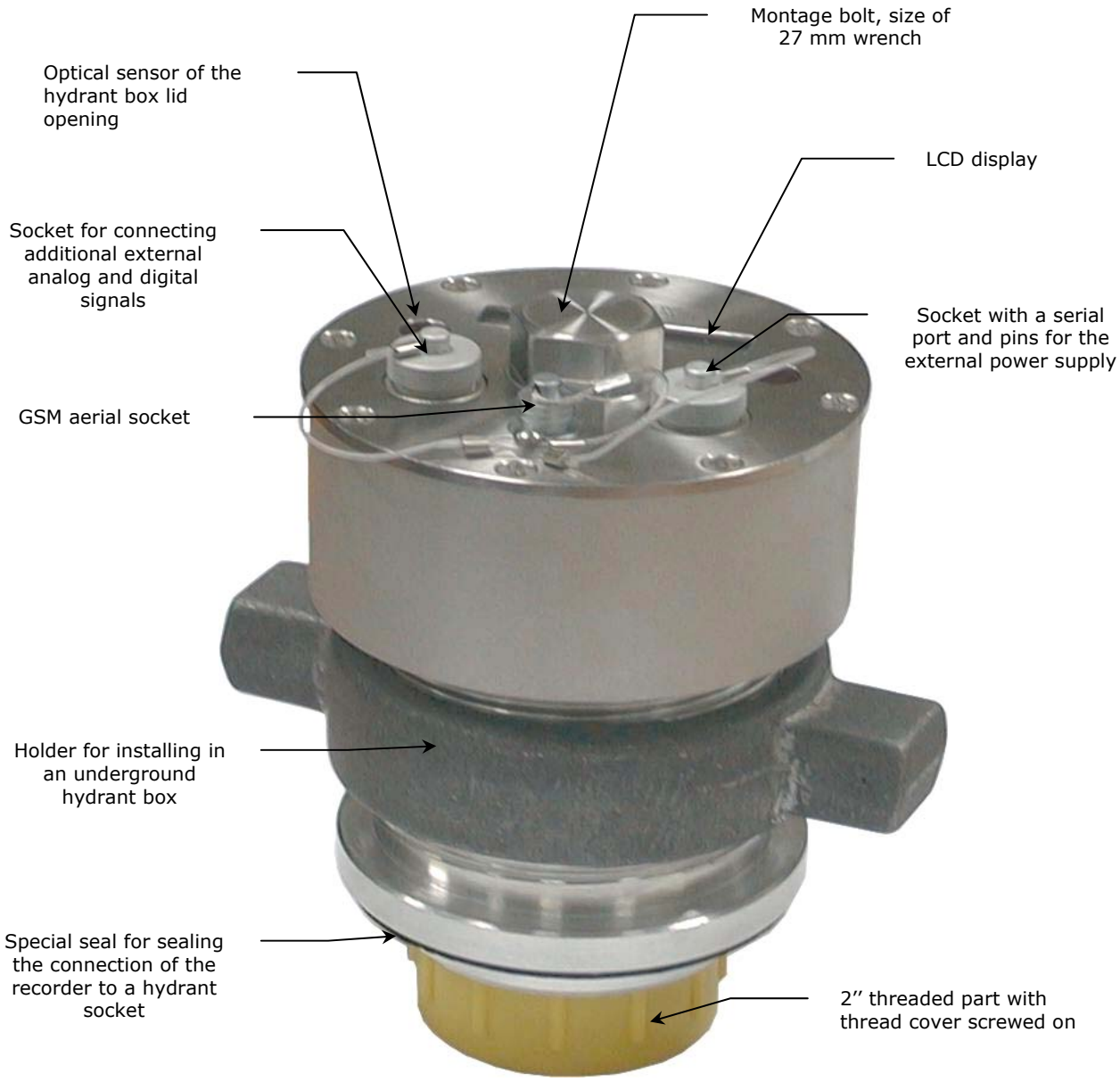
Pic. 1 Overall dimensions of the recorder, dimensions are given in [mm]

3.2.2 Arrangement of components (standard version).


Montage bolt, size of 27 mm wrench
LCD display
Optical sensor of the hydrant box lid opening
Socket for connecting additional external analog and digital signals
Socket with a serial port and pins for the external power supply
Holder for installing in an underground hydrant box
2'' threaded part with thread cover screwed on
Special seal for sealing the connection of the recorder to a hydrant socket

Pic. 2 Arrangement of components of the recorder for the version without GSM/GPRS module.

3.2.3 Arrangement of components (GSM/GPRS version).

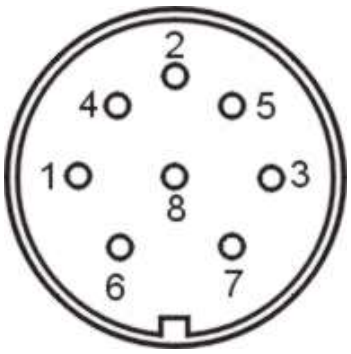

Montage bolt, size of 27 mm wrench
Optical sensor of the hydrant box lid opening
LCD display
Socket for connecting additional external analog and digital signals
Socket with a serial port and pins for the external power supply
GSM aerial socket
Holder for installing in an underground hydrant box
Special seal for sealing the connection of the recorder to a hydrant socket
2'' threaded part with thread cover screwed on

Pic. 3 Arrangement of components of the recorder for the GSM/GPRS module version.

3.2.4 Description of connectors

The device is provided with the following connectors:

a) RS232 serial port and external power supply socket (**COM**);



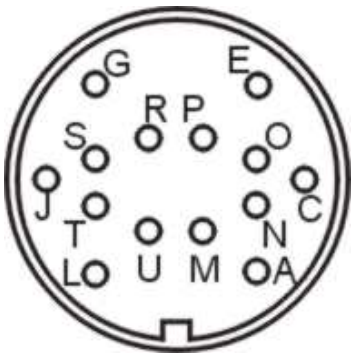
1 – CTS (input)
2 – GND (serial port ground)
3 – Rx (input)
4 – RTS (input)
5 – Tx (output)
→ RS232 serial port signals
8 – VCC_EXT (power supply of RS232 adapter from the computer)
6 – Vext2 – external power supply of CellBOX-H
7 – Vext1 – external power supply of CellBOX-H

View from the power points side (up)

Caution!

Communication with the recorder via the COM port is possible only by using the additional RS232 cable with *RS232 v. 1.40* marking. Using a different communication cable can cause damage of the device.

b) Socket for connecting additional external analog and digital signals (INPUTS);



A – DI0
N – DI1
C – DI2
R– GNDdi
→ additional digital inputs

J – +AI1
S – - AI1 (analog ground)
T– +AI2
L – - AI2 (analog ground)
U – +AI3
M – - AI3 (analog ground)
→ additional analog inputs
O – +Vai (voltage for supplying external converters provided by CellBOX-H recorder)

E – Vext2 – external power supply of CellBOX-H
G – Vext1 – external power supply of CellBOX-H P
– nc (not used)

View from the power points side (up)

Additionaly, for the option with GSM/GPRS module, the recorder is provided with the third water proof connector – aerial socket for connecting an external GSM antenna. Due to the fact that standard GSM antennas are tipped with FME plug, there is a special antenna cable in the set enabling the connection of a classic GSM antenna to the recorder. There is an option of ordering another GSM antenna with a cable tipped directly with FFA.0E.250.CTAC30 plug.

In the standard version, the recorded is provided with the following wires:

a) Communication cable, 2 m of length, tipped with connectors: DB9F – 423;

Number of the DB9F connector pin	Function
1	nc
2	Rx
3	Tx
4	DTR
5	GND
6	Nc
7	RTS
8	CTS
9	nc

nc – clamp not used

The cable connects the recorded to a PC computer (memory reading, configuration).

Pic. 4 Communication cable.

b) Standard version – AI/DI signal cable, 2 m of length tipped with 680 plug and cable tips.

Number of the 628 connector pin	Function
A	DI0
N	DI1
C	DI2
R	GNDi
J	+AI1
S	-AI1
T	+AI2
L	-AI2
U	+AI3
M	-AI3
O	+Vai
E	-Vext2
G	-Vext1
P	nc

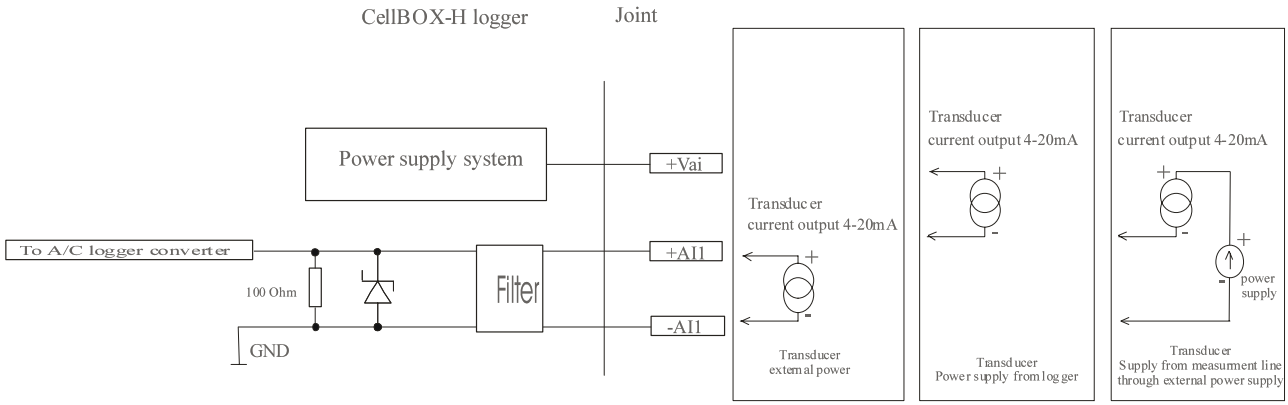
The cable plugs in external measurement converters, automation systems (water meters, terminal connectors, etc.).

Pic. 5 AI/DI signal cable.

c) Antenna cable, length of about 2 m for the option with GSM/GPRS module.

The cable with impedance of 50 Ω enables connecting an external GSM antenna. It is tipped with FFA.0E.250.CTAC30 plug (to the recorder) and FME socket (to a GSM antenna).

3.2.5 Application schemes for analog and digital inputs

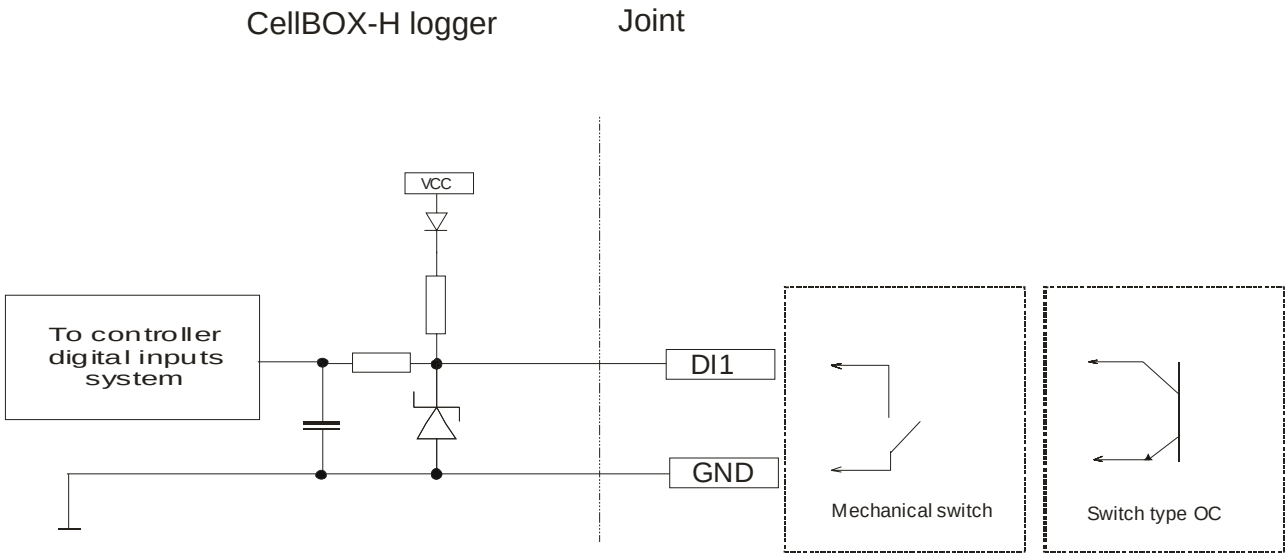


Pic. 6 Analog input (example of AI1 channel).

In the standard version, the recorder is equipped with three additional analog inputs with no galvanic separation, anti-overvoltage protected with measurement range of 4-20 mA. The user can connect any measurement converter with standard output of 4-20 mA and own power supply or use power supply of the recorder +Vai (when external power supply is used +Vai equals +Vext – 1.2V; when there is no external power supply +Vai equals the voltage of the power supply of the pressure converter from the internal battery pack, i.e. it may vary from 12 to 25 DC).

Caution:

+Vai voltage is generated only on 200 ms period with the time interval equal to the time and period of the recorder’s recording.



Pic. 7 Digital input (example of DI1 channel).

Any mechanical connector, relay pins, contractons or OC type systems can be connected to the digital inputs. The inputs can operate event type, recording state fluctuations or counter type, counting successive impulses. Maximum operation frequency of counter inputs is 100 Hz.

Analog and digital inputs are protected against application of voltage of inverse polarization and anti-overvoltage. For instalation outside a measurement well it is recommended to use signal separators.

3.2.6 Launching the recorder

The user receives the recorder equipped with an internal battery pack, thus the device is ready to operate. To prolong the batteries life in GSM/GPRS mode (option with GSM/GPRS module) it is recommended to use an external power supply.

Caution – the standard, factory configuration allows to launch the built-in GSM/GPRS modem only if there is an external power supply, e.g. external battery accumulators offered by BIATEL (in case of the

need of modem activity using also the built-in batteries, it should be specified at ordering).

The device should be configured to operate in a measurement system according to this instruction. During the first (since the purchase) launching, it can be done only via RS232 serial port using Biatel HydraNT program (PC computer or laptop is necessary and external power supply is recommended). In case of the need of later change of configuration settings, we proceed in a similar way to the first configuration but it should be remembered that a remote configuration using a GSM network via GPRS service is available in the GSM/GPRS version (activity of the internal modem during configuration of the settings of the recorder is required).

The following elements are configured:

a) 3 universal analog inputs:
   - displaying / not displaying measurement output on the LCD display;
   - range of measurement;
   - unit;
   - name;
   - alert thresholds;

b) 3 universal digital inputs:
   - type of input (event type, counter type);
   - for counter type configuration – impulse weight, start state of the counter and measurement unit;
   - for configuration of the input as event type, setting of alert thresholds (positive or negative slope alert triggering);
   - displaying / not displaying (on a display) the input state;
   - modulo – maximum counter value;

c) unit of pressure measurement: MPa or bar;

d) period of memory write of measurements (the same for all measurement inputs);
e) measurement point identifier;
f) time and date;

The recorder has the following factory configuration:

a) 3 analog inputs configured for the range of 4-20 mA – active;
b) DI1, DI2 digital inputs as displayed counter type inputs, DI3 digital input as displayed event type input responding with alert state to both positive and negative slopes;
c) start state of counters – 0, unit – m3, weight – 1;
d) period of memory write of measurements – 24 hours;
e) unit of pressure measurement – bar;
f) current time and date;

In the version with GSM/GPRS module, the following elements concerning GPRS transmission are additionally configured:

a) APN name;
b) IP number of the audio computer to which measurement data and control packs are to be sent when the modem is active;
c) port number of the audio computer;
d) 2 times of activation (time of activation 1, time of activation 2) of GPRS communication in a day's cycle (time of modem activity is 10 minutes and is extended each time the data is received via the GPRS network), at this time it is possible to read the memory content of the recorder, current measurements or change the recorder's configuration;

e) function of autodiagnosis of presence in a GPRS network. The recorder sends periodically a control pack to an IP address provided by the GPRS network. If the recorder does not receive any pack confirming its presence in the system (control data or measurement data) via the GPRS network at a given time, it sends another control pack. After three failed attempts, the device will turn the modem off and log in to the GPRS network again;
f) PIN code protecting the SIM card;

The recorder has the following factory configuration of GPRS parametres:

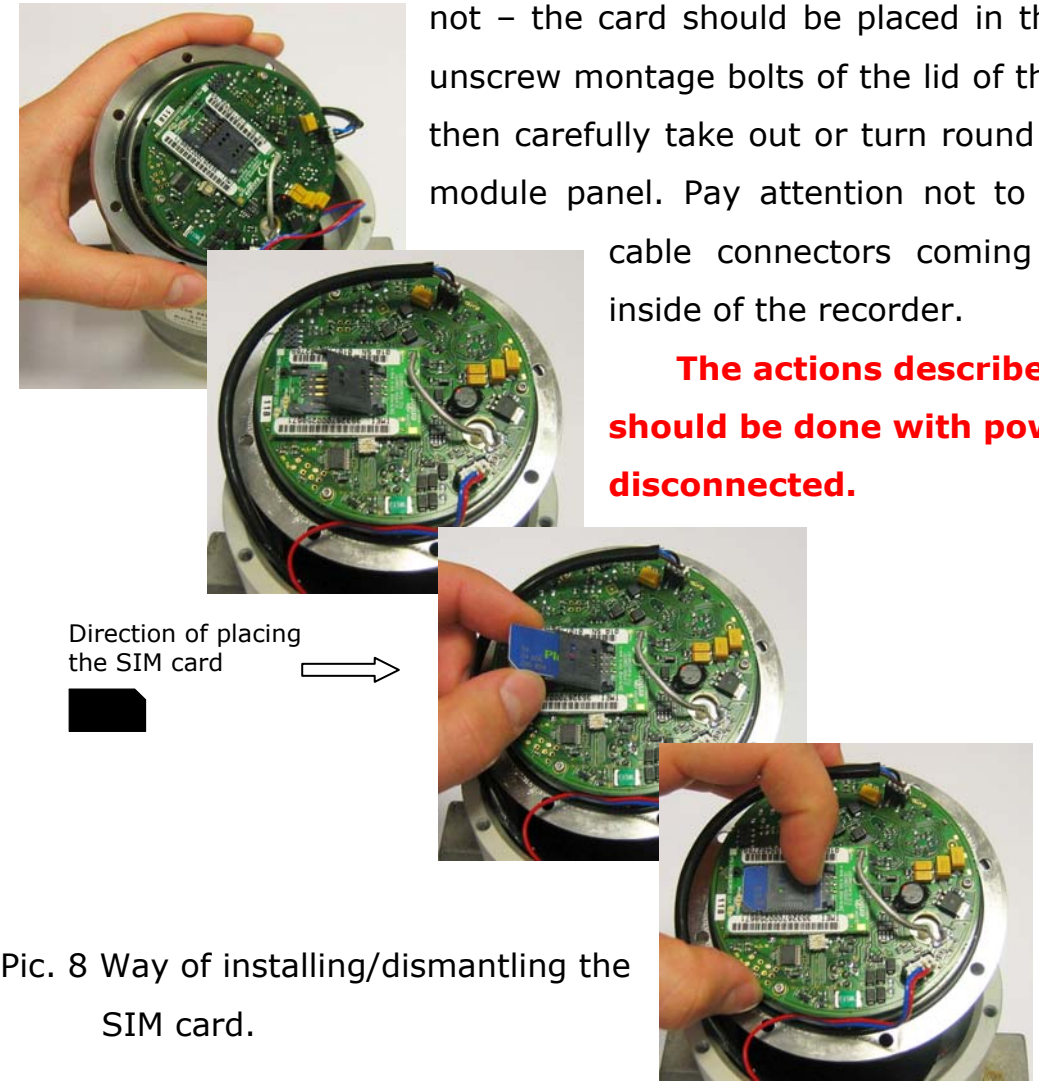
a) APN name – cellbox.pl;
b) IP address of the audio computer – 100.100.1.1;
c) port number of the audio computer – the function is inactive;
d) time of activation – function disabled;
e) function of autodiagnosis of presence in the GPRS network – active (2 minutes period);
f) PIN code = 0000;

3.2.6.1 SIM card replacement (GSM/GPRS version)

The SIM card, which will operate in the recorder, can have PIN protection turned on or off. If the PIN number is required, it should be saved in the recorder through the *Configuration->GPRS* dialog in HydraNT application. The PIN code can be saved in device only when connected through serial line. It's not possible to change PIN code while operating in GPRS mode !!!!. In case of providing a wrong code, after few attempts at launching the recorder, the card may be blocked. It should be then unblocked with the help of PUK code using any mobile phone.

Check if there is a SIM card in the SIM card socket inside the recorder (if not – the card should be placed in there). To do it, unscrew montage bolts of the lid of the recorder and then carefully take out or turn round the electronics module panel. Pay attention not to disconnect the cable connectors coming out from the inside of the recorder.

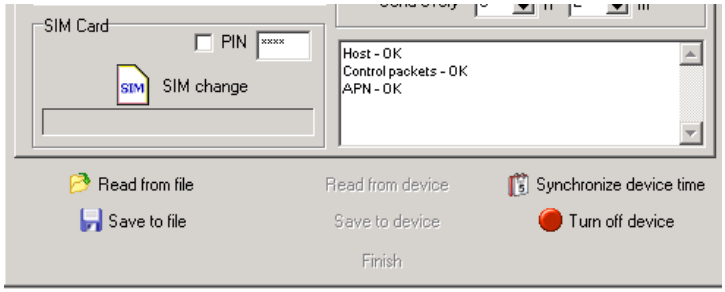
The actions described above should be done with power supply disconnected.



Pic. 8 Way of installing/dismantling the SIM card.

Connect the recorder to a computer and start the HydraNT software. Using the application ("Device settings" Menu), prepare the recorder to taking out/placing the SIM card:

- Click on the **"SIM change"** button, after the maximum of 2 minutes the modem is prepared to card replacement (switching off of the modem).



- After the **"Device Ready for SIM change."** message appears, the SIM card can be safely replaced.
- When installing the card, pay attention if its pins are turned in the direction of the circuit board of the GSM modem. After placing the SIM card, click on the **"SIM change finished"** button and then proceed with the installation of the recorder in the reverse order, paying attention to proper tightening up of montage bolts fixing the upper lid of the device and arrangement of the electrical wires.

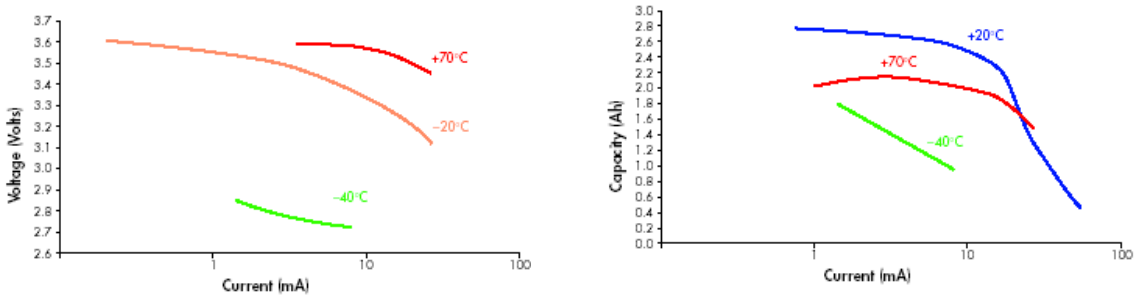
Installation and dismantling of the SIM card should be performed only with external power supply disconnected and the modem being inactive (switched off), otherwise the card can be damaged.

3.2.7 Service of the recorder

The recorder is a fully autonomical device equipped with an internal battery pack which enables it to operate for 5 years, only if the measurements are recorded each 15 minutes or more seldom.

It should be remembered that increasing the frequency of measurements or readouts without applying the external power supply shortens battery life. Time of operation of the recorder with the GSM/GPRS module active using the internal battery pack or the external accumulator pack depends strongly on the frequency of establishing a connection, its duration and signal level (the lower the signal level of a GSM network and the longer, more frequent data transmissions, the shorter the battery life – e.g. in the extreme case of non-stop active modem and the transmission of current measurements in 5 s intervals, the anticipated life, for supplying from the internal batteries, will be about 36 hours!), therefore it is recommended to use an exterior power supply unit or accumulators pack (e.g. produced by BIATEL).

The recorder controls the battery state and displays this parameter in %. A readout below 5% means that the batteries have to be immediately replaced and a readout of 0% means that the batteries are discharged. In low temperatures voltage of the batteries decreases automatically. This is a normal phenomenon and should not be treated as dicharging of the battery pack.



Pic. 9 Voltage and capacity fluctuations of a single battery cell of a battery pack in terms of current and temperature.

If after connecting the external power supply the readout of battery state is 0, it means that the power supply unit or the external accumulators pack applies too low voltage and measurements can be erratic. The recorder is resistant to a change of polarization of external power supply.

3.2.7.1 Communication

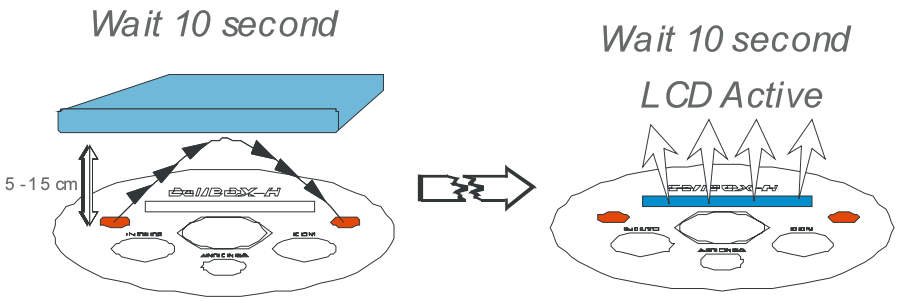
Communication with the device can be achieved using:

- LCD display;
- RS232 communication cable v. 1.40;
- GSM/GPRS network (optional).

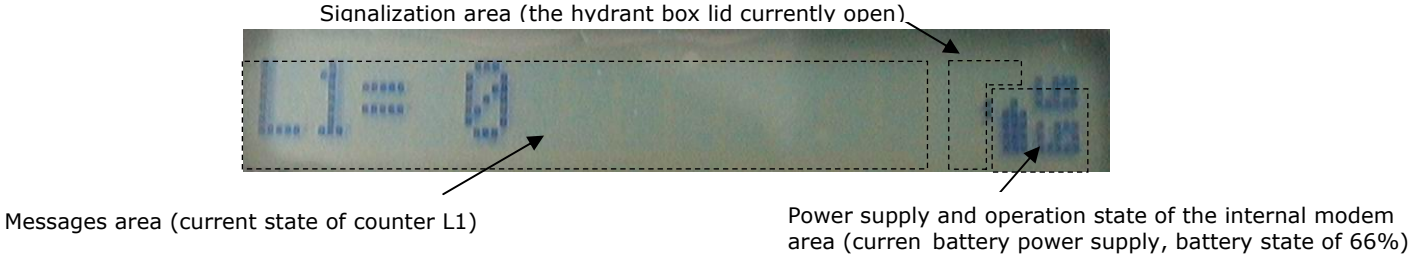
a) LCD display;

The display is activated each time the lid of the hydrant box is opened, after applying external power supply or connecting to a computer via RS232 interface. When there is no external power supply or if the device is inactive for about 5 minutes the display is off (batteries saving). Its next activation can happen when one of the mentioned events is detected. After activating the display, measurement of temperature and pressure is performed in 10 s intervals, regardless of the sampling interval set (memory write still proceeds with the sampling period set).

Regardless of the situations described above, it can be activated by covering both optical sensor windows with a metal plate for about 10 s. After uncovering, after about 10 s the display will be active.



Another way of activating the display is putting the transmission cable or service plug in the recorder's serial port (Com) for about 10 s and taking it out (the disply will turn on 10 s after taking the service plug out).


Signalization area (the hydrant box lid currently open)
Messages area (current state of counter L1)
Power supply and operation state of the internal modem
area (curren battery power supply, battery state of 66%)

Pic. 10 LCD display.

The display is divided into three areas: messages, power supply state and signalization.

- Messages area

After activating the display, the following message appears

"BIATEL S.A.", "CellBOX-H 2002" and a serial number ".....", e.g. 001462002-03.

In the messages area, the following information is displayed periodically:

- Date (day of the week, dd/mm/yyyy) e.g. Mo,11/11/2004;
- Time (hh:mm:ss) e.g. 12:10:00;
- Measurement point identifier (ID=.....) e.g. ID=HP1001; only first ten signs are displayed;
- Pressure value (P=.....bar or MPa) e.g. P=05.00bar or P=00.50MPa;
- Temperature value (T=.....ºC) e.g. T=11.2 ºC;
- Value measured on analog input AI1 (A1=..... unit of measurement) e.g. A1 = 12.3mA;
- Value measured on analog input AI2 (A2=..... unit of measurement) e.g. A2 = 990.1m3;
- Value measured on analog input AI3 (A3=..... unit of measurement) e.g. A3 = 16.1mA;

- Percentage state of battery useful voltage (BAT=.....%) e.g. BAT=40%;
- Dig. inp. state DI1,DI2,DI3 (B1= B2= B3=)

  where denotes an open input (not connected to ground);

   denotes a closed input (connected to ground);
- Counter L1 – counter state, number of impulses counted on DI1 input, (L1=.....) e.g. L1=12345;
- Counter L2 – counter state, number of impulses counted on DI2 input, (L2=.....);
- Counter L3 – counter state, number of impulses counted on DI3 input, (L3=.....);

Caution:

In case of exceeding the range of measurement of universal analog inputs, the following message will be displayed:

<range – too low measurement signal

>range – too high measurement signal

- Power supply state area

In the power supply state area two information are displayed:

- State of battery useful voltage on a scale from 0 to 99%, when there is external power supply the battery indicator shows % value of the power supply voltage;

For the GSM/GPRS version when the internal modem is active, in place of battery state, advanced modem activities (number of levels: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F,G) are displayed alternatingly:

0 - 3 – levels of modem initialization (3 – the modem is on);
4 – C – levels of logging in to a GSM network (C – being logged in to a GSM network);
C- G - GPRS service activation (G – GPRS service active);

- Symbol of active power supply:

± - external power supply - battery power supply

- Signalization area

The following information is displayed symbolically in the signalization area:

- RS232 port active;

- Hydrant box lid open;

- Digital inputs state (from the left DI1,DI2,DI3), a lit mark means input connected to ground;

b) RS232 serial port;

To communicate with the recorder, it is necessary to have Biatel HydraNT software and a special communication cable. To read the memory of the recorder, external power supply is not required, but in case of longer co-operation of the recorder with a computer, it is recommended to use an external power supply unit with voltage of 12...25 V DC in order to save the internal batteries.

Using the local port, configuration of the device and memory read can be performed. Default parameters of the serial port (we use only Rx and Tx signals for the transmission):

- Port speed: 57,600 bit/s;
- Data bits: 8;
- Parity: none;
- Stop bits: 1;
- Flow control: none

It should be remembered that when there is no data transmission, the port in CellBOX-H recorder will switch off automatically after about 5 min., although the computer is connected

to the recorder, due to saving the internal batteries. To activate it again disconnect the communication cable from the computer, wait a few seconds and connect it again.

c) GPRS network (device with GSM/GPRS module);

A few words on the GPRS service:

The GPRS technology (General Packet Radio Service) is packet data transmission, based on IP protocol, hence enabling communication by using protocols from TCP/IP family. The most basic usage of this technology is the Internet access and a more advanced one are telemetric implementations.

The system enables creating subnetworks, known as APN (Access Point Name). APN is identified by its name and is a set of information about IP addressing and routing (direction of transmission of data coming from a given APN).

Using GPRS requires having a special device, which supports this technology. It can be a mobile phone with the GPRS function (this information is given by telephone producers), a specialized GPRS modem designed to installation in the devices that implement data transmission, a modem on PCMCIA card for portable computers, or CellBOX family drivers.

Because we are dealing with a GSM network, the aforementioned device must be provided with a SIM card activated in one of the tariffs available for customers in GSM networks, on which the GPRS service is activated.

Devices that use this service are authorized by the GPRS network by comparing the SIM number with a corresponding register entry in the internal GSM database (HLR). This comparison is made during the attempt of opening a session and if a given card is not on the list of cards authorized to enter a given APN, the system will refuse to open the session.

There are two variants of terminal operation within the framework of GPRS service:

- ✓ Dynamic addressing

Addresses are assigned dynamically, which means that with each activation of a connection, the network assigns an IP address, valid through the time of

session duration, from a set of addresses specified by the user. Disconnecting and reconnecting again effects in assigning a new address.

✓ Static addressing

The client uses the static option of IP addressation. It means that the information on which IP address is going to be assigned to a given device (SIM card), which activates the connection in GPRS network, is saved in the GSM network. The same address will be assigned with each activation of the connection. Due to the fact that in the GPRS system terminals are recognized by their assigned IP addresses, the terminal that for some reason finished the session and then resumed it will always be seen under the same IP address by other terminals.

Requirements that have to be fulfilled in order to use the GSM/GPRS version of the CellBOX-H recorder:

- SIM card with an active GPRS service and static IP address (the card will operate in the recorder);
- there has to be reception of the GSM Network provider the SIM card is attributed to on the site where the recorder is installed (the antenna, to be precise);
- on the receiving side:
    - communication software, e.g. HydraNT (software for semi-automatic reading of one device – memory read, current state as well as performing remote changing of configuration and control pack management, added to each recorder) or a dedicated application managing a telemetrical system and providing visualization of operating state of a number of devices, e.g. TelWin;
    - CellBOX-U driver or a GSM/GPRS modem (another SIM card with GPRS service, Dial-Up type connection or permanent connection to APN).

3.2.8 CellBOX-H Hydrant installation

Instructions concerning the installation of a configured recorder:

Step 1:

Rinse and clean the terminal where the recorder will be installed, e.g. hydrant termimal in case of installing in a hydrant box.

To do this, unscrew the hydrant valve slowly so that the water column reaches the outlet. In such way, too great pressure impulse load of the sensor is avoided. It is valid for other types of installation as well. After installing the recorder, unscrew the hydrant valve completly. For installing recorders use only a 27 mm wrench.

Turning the lower clamp part of the recorder, move it completely down, then place the device between hydrant claws and pull it up with a wrench. Remember not to remove the plastic cap from the 2'' threaded part. Its role is to shield this thread during installation operations of the recorder in an underground hydrant box.

In case of installing CellBOX-H recorder outside an underground hydrant box, use reductors tipped with 2'' female thread and proper sealing materials, e.g. PTFE teflon tape.

Step 2:

Connect (optionally) external automation systems (measurement converters, terminal connectors, relays, etc.) – Pic. 5, 6, using the cable provided or preparing an own cable according to pt. 3.2.4.

Step 3 (wersja GSM/GPRS):

Place the GSM antenna on such a site that the level of signal was maximal. It can be checked by using any GSM modem after giving it a command at+csq (detailed command description in the GSM modem documentation). Another method of checking the signal level (the method of estimation) is using a mobile phone with a SIM card of the same provider as in the recorder. Plug the plug of GSM antenna into the right socket (Pic. 3);

Make sure that all connectors and stops are tightened up well, in case of incorrect tightening up of the plug or the stop of the connector, the recorder can be flooded by water and thus damaged.

3.2.9 Dismantling

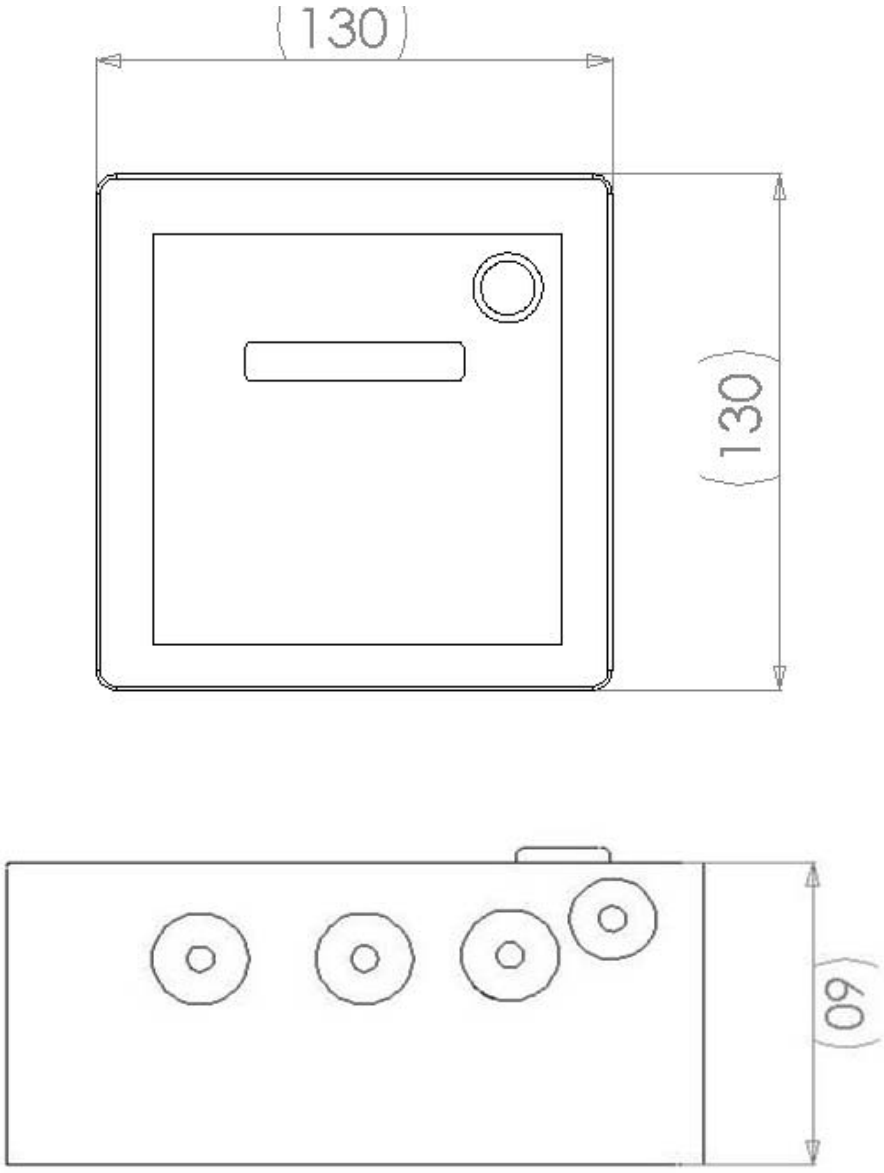
Before dismantling the recorder it is absolutely necessary to close the hydrant or another valve sealing off the pressure from the place of the CellBOX-H Hydrant recorder installation!!!

Then, unscrew the device using 27 mm wrench. To avoid accidents, it is recommended to read the pressure from CellBOX-H recorder first. When the display is active, pressure (and temperature) measurement is performed in intervals of ten to twenty seconds, regardless of the basic sampling interval set.

Attention: the device is equipped with water proof connectors. Sockets which are not being used must be always closed with special caps provided with the recorder. The connectors fulfill IP68 requirements only when they are blinded with the right cap or have the right plug inserted (the plug should be tighten up).

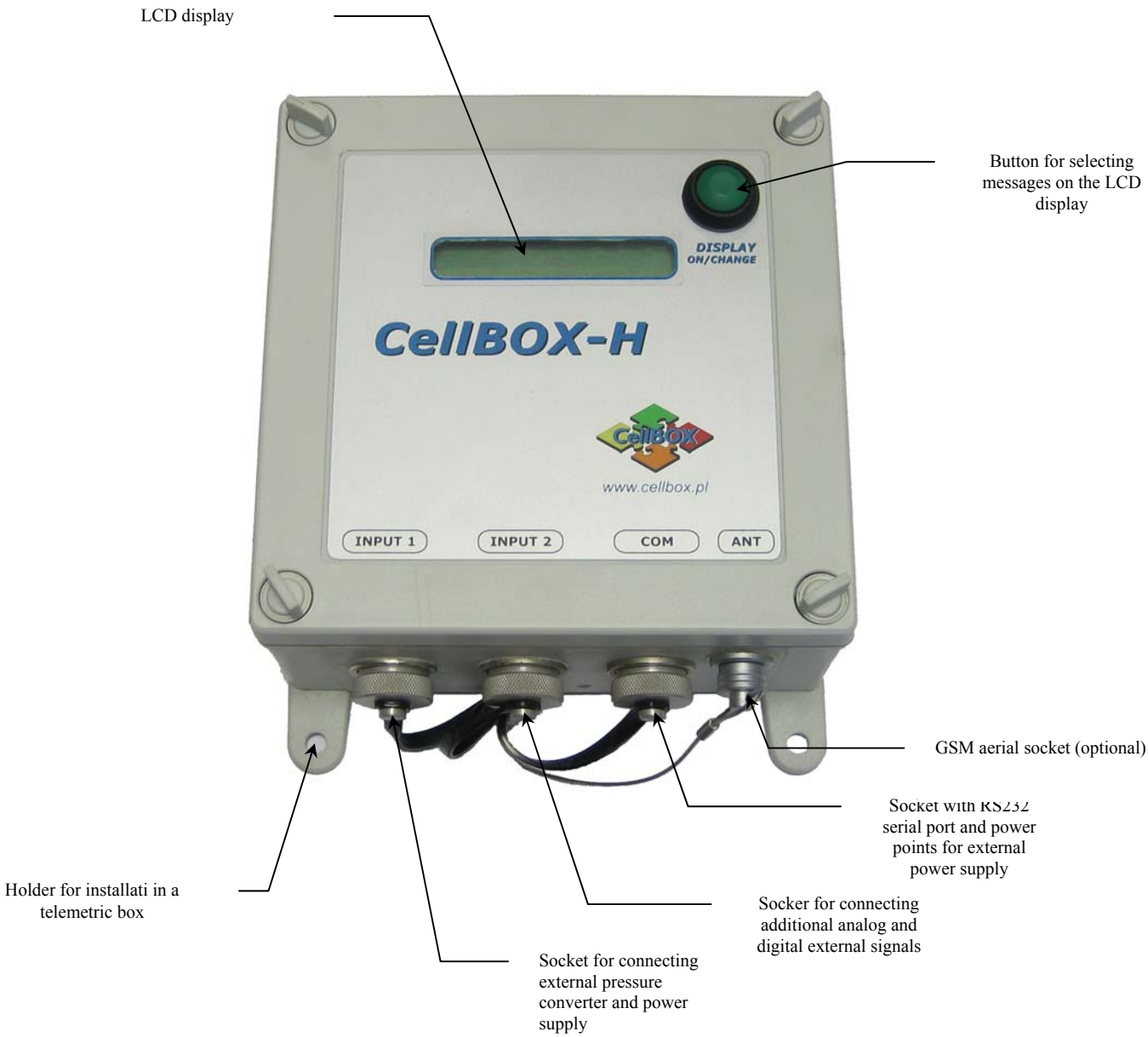
3.3 Installation – Recorder in a plastic case.

3.3.1. CellBOX-H BOX overall dimensions



Pic. 11 Overall dimensions of the recorder, dimensions given in [mm]

3.3.2. Arrangement of components (standard version).

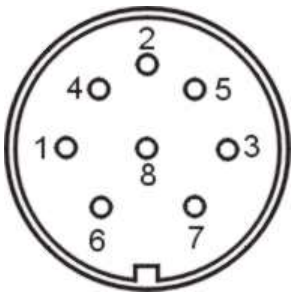

LCD display
Button for selecting messages on the LCD display
DISPLAY ON/CHANGE
CellBOX-H
www.cellbox.pl
INPUT 1
INPUT 2
COM
ANT
GSM aerial socket (optional)
Socket with RS232 serial port and power points for external power supply
Holder for installati in a telemetric box
Socker for connecting additional analog and digital external signals
Socket for connecting external pressure converter and power supply

Pic. 12 Arrangement of the components of the recorder.

3.3.3 Description of connectors

In the standard version, the device in a plastic case with sockets of series 723 is equipped with three connectors denoted as Input 1, Input 2 and Com:

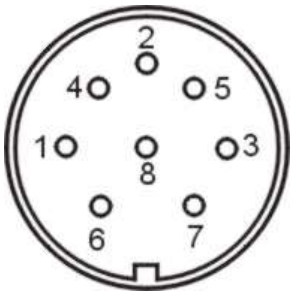
a) serial port and power supply socket (**COM**);



1 – CTS (input)
2 – GND (serial port ground)
3 – Rx (input)
4 – RTS (input)
5 – Tx (output)
→ RS232 serial port signals
8 – VCC_EXT (power supply of RS232 adapter from the computer)
6 – Vext2 – external power supply of CellBOX-H
7 – +Vext1 – external power supply of CellBOX-H

View from the power points side (up)

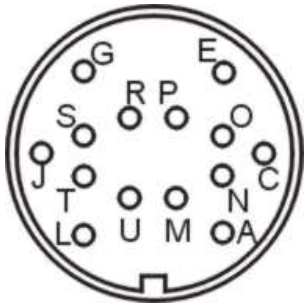
b) **Input 1 –** socket for connecting external pressure converter with output electrical signal of 4-20 mA and power supply



1 – nc
2 – P_GND (analog ground)
3 – nc
4– nc
5 – Pin (input of 4-20mA signal)
→ pressure measurement
8 – + Vp (power supply of external converter)
6 – GNDext - external power supply unit ground
7 – +Vext - positive terminal of external power supply unit

View from the power points side (up)

c) **Input 2 –** socker for connecting additional external analog and digital signals and power supply



– DI0
N – DI1 → additional digital inputs
C – DI2
R– GNDdi

J – +AI1
S – - AI1 (analog ground)
T– +AI2
L – - AI2 (analog ground) → additional analog inputs
U – +AI3
M – - AI3 (analog ground)
O – +Vai (voltage for supplying external converters provided by CellBOX-H recorder)

E – Vext2 – external power supply of CellBOX-H
G – Vext1 – external power supply of CellBOX-H
P– nc (not used)

View from the power points side (up)

Additionally, for the version with GSM/GPRS module, the recorder is provided with the third connector – aerial socket for connecting an external GSM antenna. For IP67 version this is the ERA.0E.250.CTL socket while for IP65 version this is FME socket.

In the standard version, the recorded is provided with the following wires:

a) **Transmission cable, Recorder – computer connection**

Function	DB9F pin number
Rx	3
GND	5
Tx	2

The cable connects the recorded to a PC computer (memory reading, configuration).

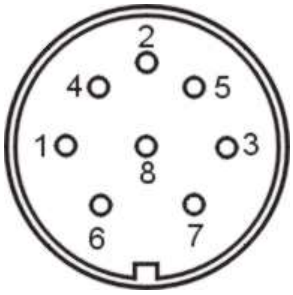
Pic. 13 Communication cable RS232 v. 1.40.

View from the brazing pins side

b) **INPUT 1** signal cable

Recorder – converter connection

723 socket pin number	Function
2	-Pin
5	+Pin
6	GNDext
7	+Vext
8	+VP



View from the brazing pins side

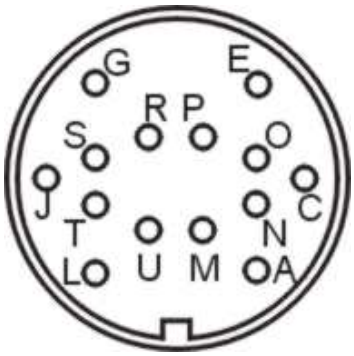
Pic. 14 Recorder-converter cable.

d) **INPUT2** signal cable

Recorder – converters connection

A	DI0
N	DI1
C	DI2
R	GNDi
J	+AI1
S	-AI1
T	+AI2
L	-AI2
U	+AI3
M	-AI3
O	+Vai
E	Vext2
G	Vext1
P	nc

The cable connects external measurement converters, automation systems (water meters, terminal connectors, etc.)



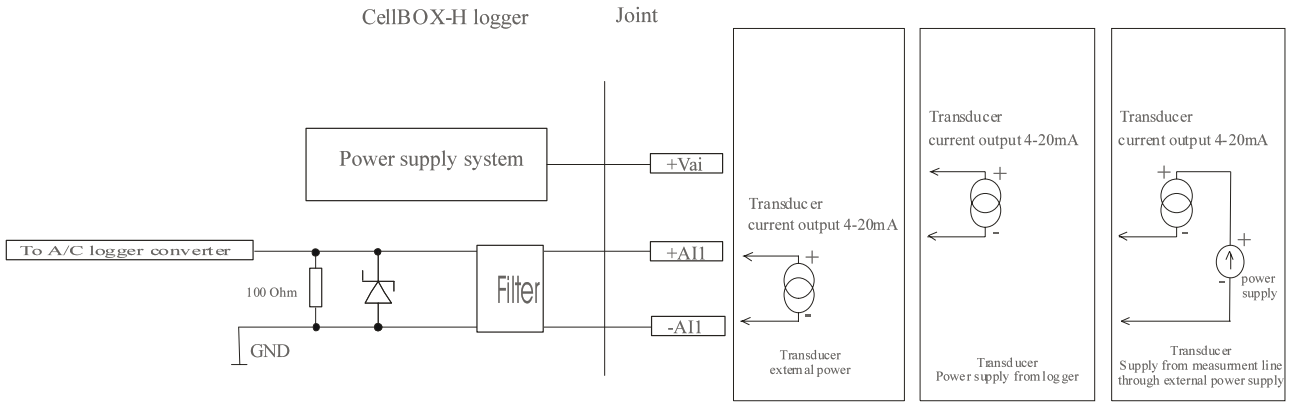
View from the brazing pins side

Pic. 15 AI/DI signal cable.

d) Antenna cable, length of about 2 m for the option with GSM/GPRS module.

The cable with impedance of 50 Ω enables connecting an external GSM antenna. It is tipped with FFA.0E.250.CTAC30 plug – IP67 option, or FME socket for IP65 option.

3.3.4 Application schemes for analog and digital inputs



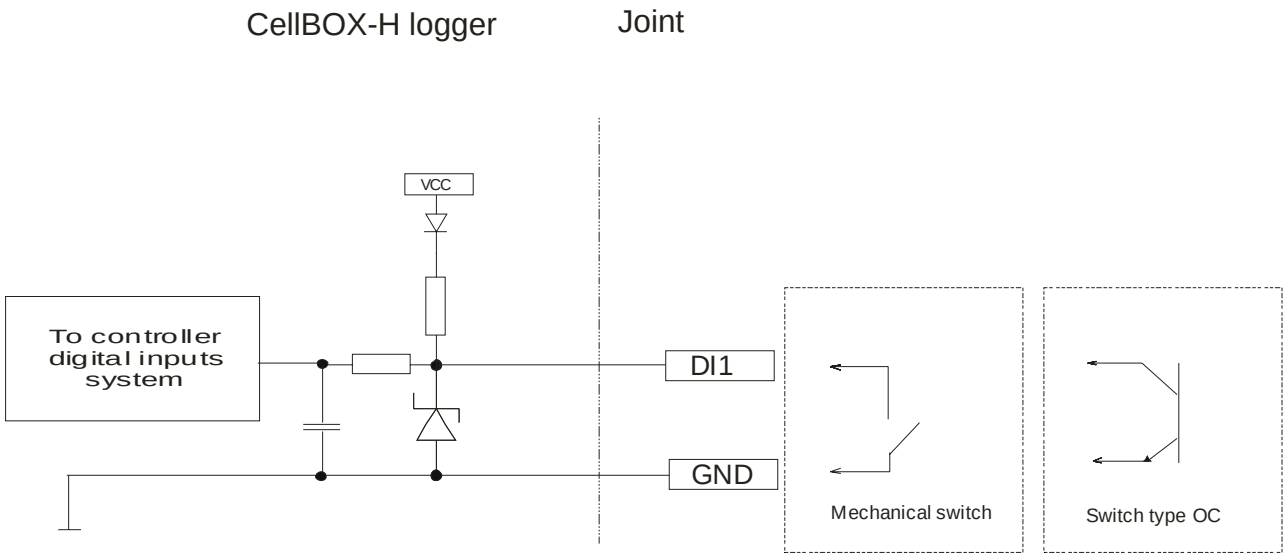
Pic. 16 Analog input (example of AI1 channel).

In the standard version, the recorder is equipped with three additional analog inputs with no galvanic separation, anti-overvoltage protected with measurement range of 4-20 mA. The user can connect any measurement converter with standard output of 4-20 mA and own power supply or use

power supply of the recorder +Vai (when external power supply is used +Vai equals +Vext – 1.2V; when there is no external power supply +Vai equals the voltage of the power supply of the pressure converter from the internal battery pack, i.e. it may vary from 12 to 25 DC).

Caution:

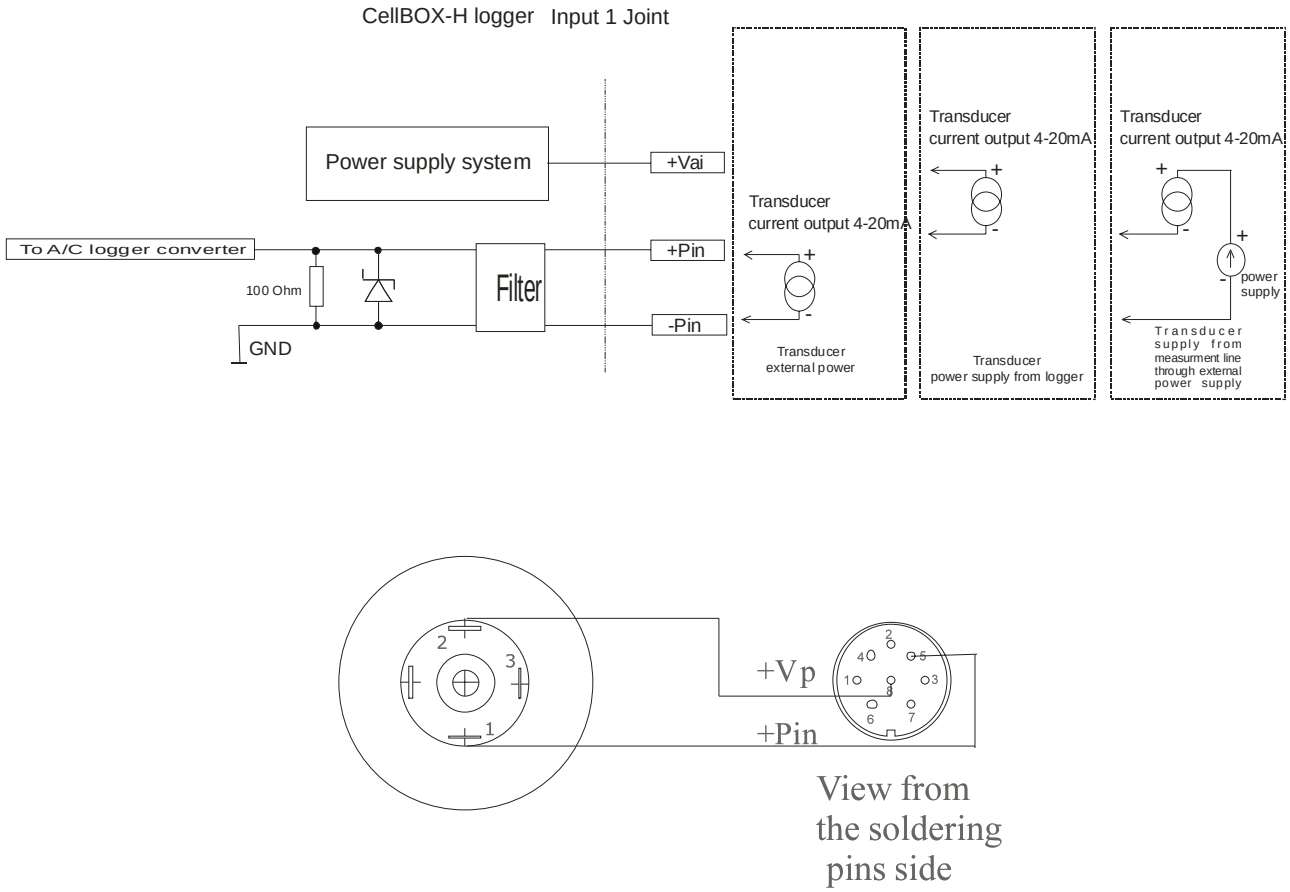
+Vai voltage is generated only on 200 ms period with the time interval equal to the time and period of the recorder's recording.



Pic. 17 Digital input (example of DI1 channel).

Any mechanical connector, relay pins, contractons or OC type systems can be connected to the digital inputs. The inputs can operate event type, recording state fluctuations or counter type, counting successive impulses. Maximum operation frequency of counter inputs is 100 Hz.

Analog and digital inputs are protected against application of voltage of inverse polarization and anti-overvoltage. For instalation outside a measurement well it is recommended to use signal separators.



Pic. 18 Input 1 analog input (An example of connecting a pressure converter).

3.3.5 Launching the recorder

The user receives the recorder equipped with an internal battery pack, thus the device is ready to operate. To prolong the batteries life in GSM/GPRS mode (option with GSM/GPRS module) it is recommended to use an external power supply.

Caution – the standard, factory configuration allows to launch the built-in GSM/GPRS modem only if there is an external power supply, e.g. external battery accumulators offered by BIATEL (in case of the need of modem activity using also the built-in batteries, it should be specified at ordering).

The device should be configured to operate in a measurement system according to this instruction. During the first (since the purchase) launching, it can be done only via RS232 serial port using Biatel HydraNT program (PC computer or laptop is necessary and external power supply is recommended). In case of the need of later change of configuration settings, we proceed in a similar way to the first configuration but it should be remembered that a remote configuration using a GSM network via GPRS service is available in the GSM/GPRS version (activity of the internal modem during configuration of the settings of the recorder is required).

The following elements are configured:

g) 3 universal analog inputs:
- displaying / not displaying measurement output on the LCD display;
- range of measurement;
- unit;
- name;
- alert thresholds;

h) 3 universal digital inputs:
   - type of input (event type, counter type);
   - for counter type configuration – impulse weight, start state of the counter and measurement unit;
   - displaying / not displaying (on a display) the input state;
   - for configuration of the input as event type, setting of alert thresholds (positive or negative slope alert triggering);
   - modulo – maximum counter value;

i) unit of pressure measurement: MPa or bar;
j) period of memory write of measurements (the same for all measurement inputs);
k) measurement point identifier;
l) time and date;

The recorder has the following factory configuration:

g) 4 analog inputs configured for the range of 4-20 mA – active;
h) DI1, DI2 digital inputs as displayed counter type inputs, DI3 digital input as displayed event type input responding with alert state to both positive and negative slopes;
i) start state of counters – 0, unit – m3, weight – 1;
j) period of memory write of measurements – 15 min;
k) unit of pressure measurement – bar;
l) current time and date (winter time);
m) range of measurement for *INPUT 1* inputs 0-16 bar

In the version with GSM/GPRS module, the following elements concerning GPRS transmission are additionally configured:

g) APN name;

h) IP number of the audio computer to which measurement data and control packs are to be sent when the modem is active;
i) port number of the audio computer;
j) 2 times of activation (time of activation 1, time of activation 2) of GPRS communication in a day's cycle (time of modem activity is 10 minutes and is extended each time the data is received via the GPRS network), at this time it is possible to read the memory content of the recorder, current measurements or change the recorder's configuration;
k) function of autodiagnosis of presence in a GPRS network. The recorder sends periodically a control pack to an IP address provided by the GPRS network. If the recorder does not receive any pack confirming its presence in the system (control data or measurement data) via the GPRS network at a given time, it sends another control pack. After three failed attempts, the device will turn the modem off and log in to the GPRS network again;
l) PIN code protecting the SIM card;

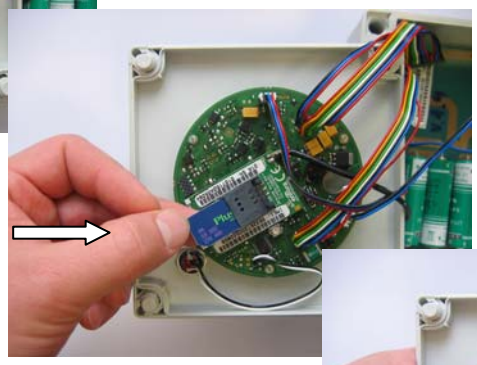
The recorder has the following factory configuration of GPRS parametres:

g) APN name – cellbox.pl;
h) IP address of the audio computer – 100.100.1.1;
i) port number of the audio computer – the function is inactive;
j) time of activation – function disabled;
k) function of autodiagnosis of presence in the GPRS network – active (2 minutes period);
l) PIN code = 0000;

3.3.5.1 SIM card replacement (GSM/GPRS version)

The SIM card, which will operate in the recorder, can have PIN protection turned on or off. If the PIN number is required, it should be saved in the recorder through the *Configuration->GPRS* dialog in HydraNT application. The PIN code can be saved in device only when connected through serial line. It's not possible to change PIN code while operating in GPRS mode !!!!. In case of providing a wrong code, after few attempts at launching the recorder, the card may be blocked. It should be then unblocked with the help of PUK code using any mobile phone.

Check if there is a SIM card in the SIM card socket inside the recorder (if not – the card should be placed in there). To do it, unscrew 4 montage bolts of the upper lid of the recorder and then carefully take out or turn round the electronics module panel. Pay attention not to disconnect the cable connectors coming out from the inside of the recorder.



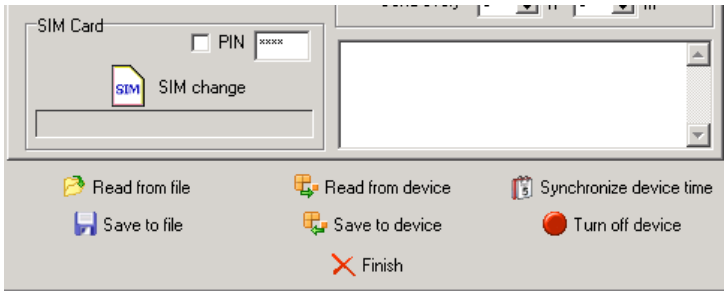
Direction of placi e SIM card

The actions described above should be done with power supply disconnected.

Pic. 19 Way of installing/dismantling the SIM card.

Connect the recorder to a computer and start the HydraNT software. Using the application ("Device settings" Menu), prepare the recorder to taking out/placing the SIM card:

- Click on the **"SIM change"** button, after the maximum of 2 minutes the modem is prepared to card replacement (switching off of the modem).



- After the **"Device ready for SIM change."** message appears, the SIM card can be safely replaced.
- When installing the card, pay attention if its pins are turned in the direction of the circuit board of the GSM modem. The SIM card socket is placed in the GSM modem on the circuit board (pic. 19).
- After placing the SIM card, click on the **"SIM change finished"** button and then proceed with the installation of the recorder in the reverse order, paying attention to proper tightening up of montage bolts fixing the upper lid of the device and arrangement of the electrical wires.

Installation and dismantling of the SIM card should be performed only with external power supply disconnected and the modem being inactive (switched off), otherwise the card can be damaged.

3.3.6 Service of the recorder

The recorder is a fully autonomical device equipped with an internal battery pack which enables it to operate for 5 years, only if the measurements are recorded each 15 minutes or more seldom.

It should be remembered that increasing the frequency of measurements or readouts without applying the external power supply shortens battery life. Time of operation of the recorder with the GSM/GPRS module active using the internal battery pack or the external accumulator pack depends strongly on the frequency of establishing a connection, its duration and signal level (the lower the signal level of a GSM network and the longer, more frequent data transmissions, the shorter the battery life – e.g. in the extreme case of non-stop active modem and the transmission of current measurements in 5 s intervals, the anticipated life, for supplying from the internal batteries, will be about 36 hours!), therefore it is recommended to use an exterior power supply unit or accumulators pack (e.g. produced by BIATEL).

The recorder controls the battery state and displays this parameter in units of voltage [V]. The right readouts should be of about 25.2 [V]. Readout below 21 [V] means that the batteries have to be replaced soon and readout below 19.6 [V] means that the batteries are discharged. In low temperatures voltage of the batteries automatically decreases. This is a normal phenomenon and should not be treated as discharging of the battery pack.

If after connecting the external power supply the readout of battery state is below 19.6 [V], it means that the power supply unit or the external accumulators pack applies too low voltage and measurements can be erratic. The recorder is resistant to a change of polarization of external power supply.

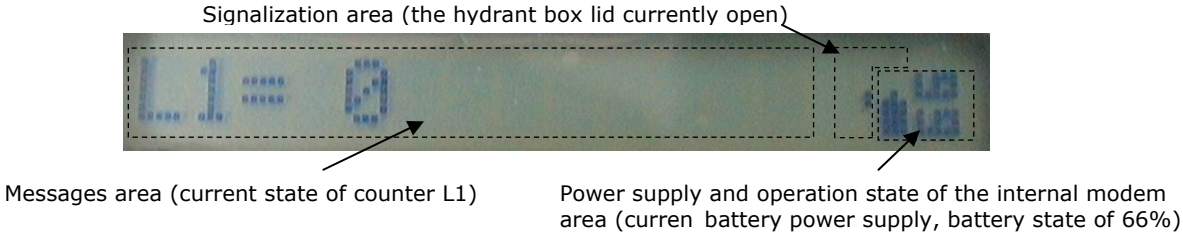
3.3.6.1 Communication

Communication with the device can be achieved using:

- LCD display;
- serial port;
- GSM/GPRS network (optional).

e) LCD display

The display is each time activated using the button for changing the displayed messages, after applying external power supply or connecting to a computer via serial port. When there is no external power supply or if the device is inactive for about 5 minutes the display is off (batteries saving). Its next activation can happen when one of the events mentioned above is detected. After activating the display, measurement of temperature and pressure is performed in 10 s intervals, regardless of the sampling interval set (memory write still proceeds with the sampling period set).


Signalization area (the hydrant box lid currently open)
Messages area (current state of counter L1)
Power supply and operation state of the internal modem
area (curren battery power supply, battery state of 66%)

Pic. 20 LCD display.

The display is divided into three areas: messages, power supply state and signalization.

- Messages area

After activating the display, the following message appears

"BIATEL S.A.", "CellBOX-H 2002" and a serial number ".....", e.g. 001462002-03.

In the messages area, the following information is displayed periodically:

- Date (day of the week, dd/mm/yyyy) e.g. Mo,11/11/2004;
- Time (hh:mm:ss) e.g. 12:10:00;
- Measurement point identifier (ID=.....) e.g. ID=HP1001; only first ten signs are displayed;
- Pressure value (P=.....bar or MPa) e.g. P=05.00bar or P=00.50MPa;
- Temperature value (T=.....ºC) e.g. T=11.2 ºC;
- Value measured on analog input AI1 (A1=..... unit of measurement) e.g. A1 = 12.3mA;
- Value measured on analog input AI2 (A2=..... unit of measurement) e.g. A2 = 990.1m3;
- Value measured on analog input AI3 (A3=..... unit of measurement) e.g. A3 = 16.1mA;
- State of battery useful voltage (BAT=.....[V]) e.g. BAT=10 [V];
- Dig. inp. state DI1,DI2,DI3 (B1= B2= B3=)
  where denotes an open input (not connected to ground);
  denotes a closed input (connected to ground);
- Counter L1 – counter state, number of impulses counted on DI1 input, (L1=.....) e.g. L1=12345;
- Counter L2 – counter state, number of impulses counted on DI2 input, (L2=.....);
- Counter L3 – counter state, number of impulses counted on DI3 input, (L3=.....);

Caution:

In case of exceeding the range of measurement of universal analog inputs, the following message will be displayed:

<range – too low measurement signal

>range – too high measurement signal

- Power supply state area

In the power supply state area two information are displayed:

- Battery or external accumulators voltage state

For the GSM/GPRS version when the internal modem is active, in place of battery state, advanced modem activities (number of levels: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F,G) are displayed alternatingly:

0 - 3 – levels of modem initialization (3 – the modem is on);
4 – C – levels of logging in to a GSM network (C – being logged in to a GSM network);
C- G - GPRS service activation (G – GPRS service active);

- Symbol of active power supply:

± - external power supply - battery power supply

- Signalization area

The following information is displayed symbolically in the signalization area:

- RS232 port active;

- Hydrant box lid open;

- Digital inputs state (from the left DI1,DI2,DI3), a lit mark means input connected to ground;

f) RS232 serial port;

To communicate with the recorder, it is necessary to have Biatel HydraNT software and a special communication cable. To read the memory of the recorder, external power supply is not required, but in case of longer co-operation of the recorder with a computer, it is recommended to use an

external power supply unit with voltage of 12...25 V DC in order to save the internal batteries.

Using the local port, configuration of the device and memory read can be performed. Default parameters of the serial port (we use only Rx and Tx signals for the transmission):

- Port speed: 57,600 bit/s;
- Data bits: 8;
- Parity: none;
- Stop bits: 1;
- Flow control: none

It should be remembered that when there is no data transmission, the port in CellBOX-H recorder will switch off automatically after about 5 min., although the computer is connected to the recorder, due to saving the internal batteries. To activate it again disconnect the communication cable from the computer, wait a few seconds and connect it again.

Port speed different than 57,600 bit/s, set from HydraNT software, is active only when there is a recorder connected to the computer. After disconnecting the communication cable or after automatic switching off of the communication port of the recorder, the speed of 57,600 bit/s is restored.

g) GPRS network (device with GSM/GPRS module);

Requirements that have to be fulfilled in order to use the GSM/GPRS version of the CellBOX-H recorder:

- SIM card with an active GPRS service and static IP address (the card will operate in the recorder);
- there has to be reception of the GSM Network provider the SIM card is attributed to on the site where the recorder is installed (the antenna, to be precise);
- on the receiving side:
    - communication software, e.g. HydraNT (software for semi-automatic reading of one device – memory read,

current state as well as performing remote changing of configuration and control pack management, added to each recorder) or a dedicated application managing a telemetrical system and providing visualization of operating state of a number of devices, e.g. TelWin;

- CellBOX-U driver or a GSM/GPRS modem (another SIM card with GPRS service, Dial-Up type connection or permanent connection to APN).

3.3.7 Installation

Instructions concerning the installation of a configured recorder:

Step 1:
Pay attention as to the conditions the device is going to operate in. Depending on the place of destination, use IP65 or IP67 class devices. Avoid places where there is hazard of flooding by water or other substances. Install the device using proper screws and holders so that there was easy access to the device and electric connections.

Step 2:

Connect external automation systems (measurement converters, terminal connectors, relays, etc.) – Pic. 15, 16, 17, using the cable provided or preparing an own cable according to pt. 3.2.10.

Step 3 (wersja GSM/GPRS):

Place the GSM antenna on such a site that the level of signal was maximal. It can be checked by using any GSM modem after giving it a command at+csq (detailed command description in the GSM modem documentation). Another method of checking the signal level (the method of estimation) is using a mobile phone with a SIM card of the same provider as in the recorder. Plug the plug of GSM antenna into the right socket (Pic. 13);

CAUTION: The IP67 version of the divice is equipped with water proof connectors. Sockets that are not being used must always be enclosed by special caps provided with the recorder. The connectors fulfill IP67 requirements only when they are blinded with the right cap or have the right plug inserted (the plug should be tightened up).

4. Biatel HydraNT Communication Software.

Biatel HydraNT version 1.3 application is a program which carries out the communication between the recorder and the computer. The application enables:

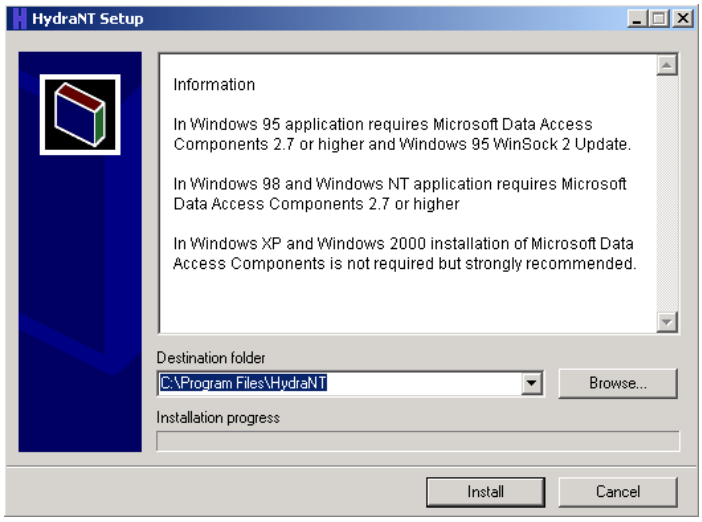
- configuration of the recorder;
- data read from measurements recorded in the device's memory;
- data export to Excel or a text file;
- data import from Excel or a text file;
- plotting of diagrams;
- printing of diagrams;

Biatel HydraNT application consists of the following files:

- HydraNT.exe (executable program);
- config.ini (configuration data of the program);

There is a CD installation version of the program as well as a 1.44M disk installation version on the CD.

Program installation is achieved by running the Instalator HydraNT.exe installation application.

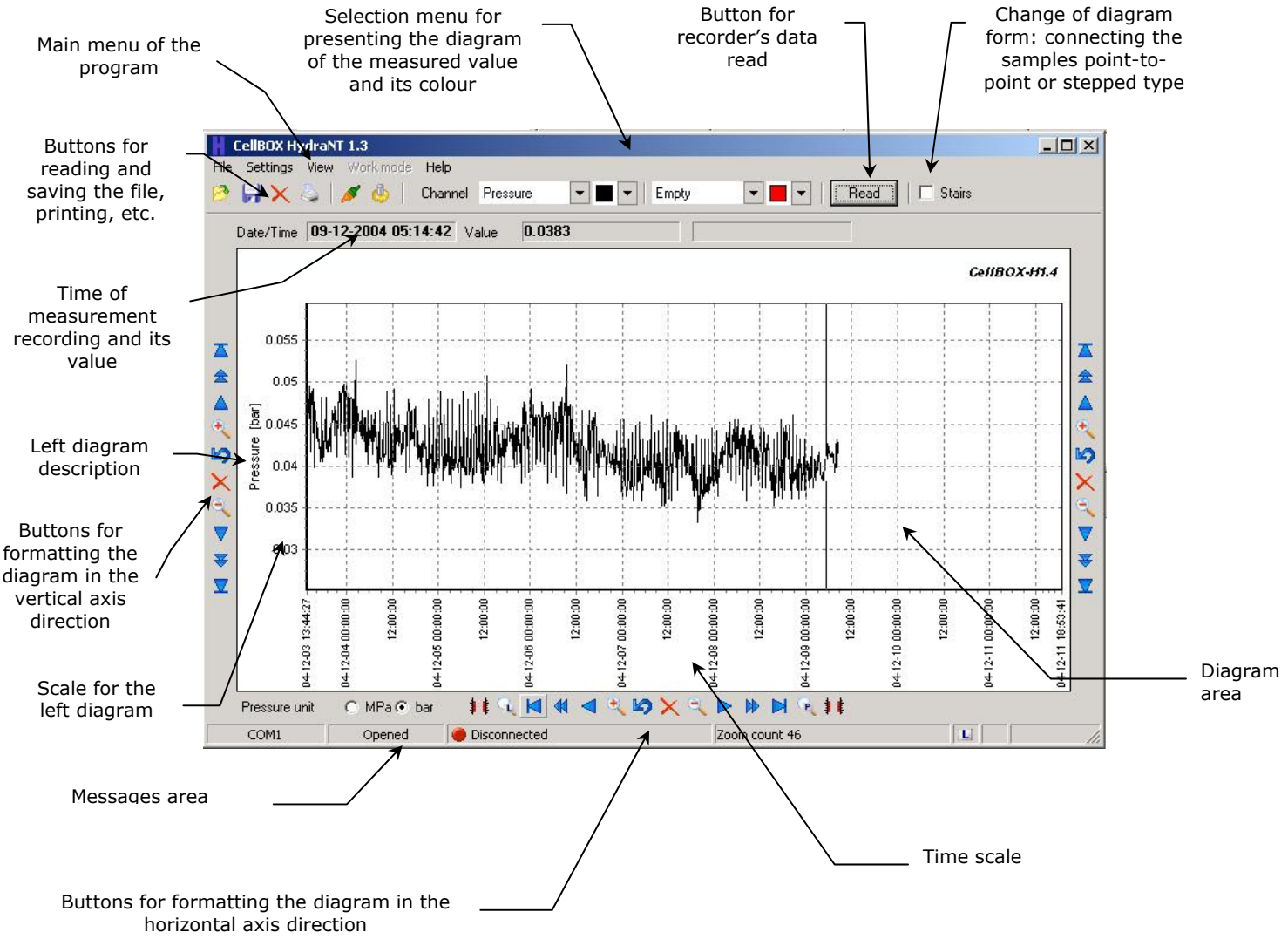

HydraNT Setup
Information
In Windows 95 application requires Microsoft Data Access Components 2.7 or higher and Windows 95 WinSock 2 Update.
In Windows 98 and Windows NT application requires Microsoft Data Access Components 2.7 or higher
In Windows XP and Windows 2000 installation of Microsoft Data Access Components is not required but strongly recommended.
Destination folder
C:\Program Files\HydraNT
Browse...
Installation progress
Install
Cancel

After accepting the licence conditions, HydraNT application will be installed in a selected directory.

The minimum operational screen resolution is 800x600.

Before starting the installation of HydraNT software, acquaint with the content of "czytaj.txt" file, where instructions concerning HydrantNT software installation for different operating systems are included.

4.1 Main window of HydraNT program


Main menu of the program
Selection menu for presenting the diagram of the measured value and its colour
Button for recorder's data read
Change of diagram form: connecting the samples point-to-point or stepped type
Buttons for reading and saving the file, printing, etc.
Time of measurement recording and its value
Left diagram description
Buttons for formatting the diagram in the vertical axis direction
Scale for the left diagram
Messages area
Buttons for formatting the diagram in the horizontal axis direction
Time scale
Diagram area
CellBOX HydraNT 1.3
File Settings View Work mode Help
Channel Pressure Empty Read Stairs
Date/Time 09-12-2004 05:14:42 Value 0.0383
CellBOX-H1.4
Pressure [bar]
Pressure unit MPa bar
COM1 Opened Disconnected Zoom count 46

Pic. 21 Main menu of the program.

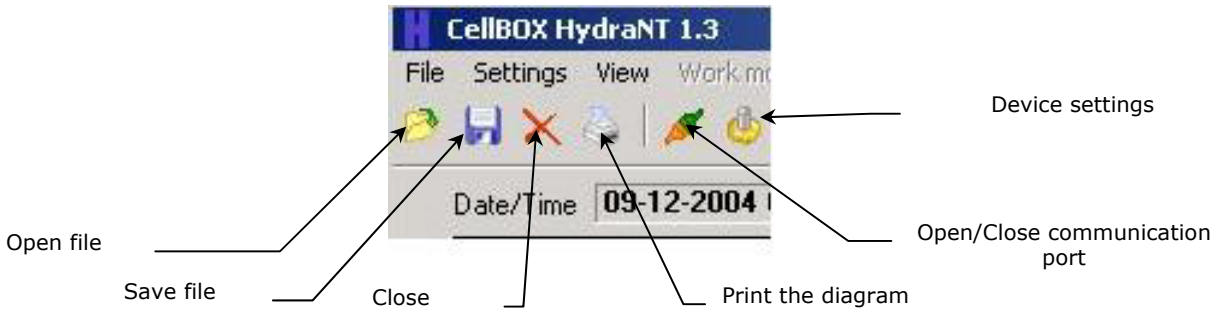
From the main window of the application we can read data from the recorder, save the results of a recording to a file in Excel or text file format, load the saved file, view data in the form of a diagram or configure the device.

4.2 Main Menu of the program

The access to the main menu box is possible by mouse-clicking the correct option from the menu or by pressing the combination of keys, "Alt" + letter underscored in the option from the menu, e.g.

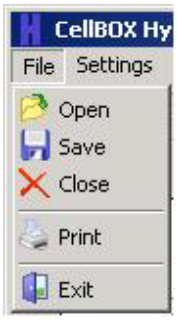
Menu File – "Alt" + "f". Similarly, navigation in options selected from the menu is possible by mouse-clicking the option from the menu or pressing the combination of keys, "Alt" + letter underscored in the option that interests us.

In the upper-left corner of the main window of the program, there are 6 buttons enabling fast access to selected options from the menu.



Pic. 22 Buttons of fast menu access.

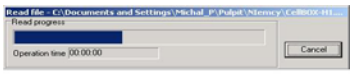
4.2.1 Menu File

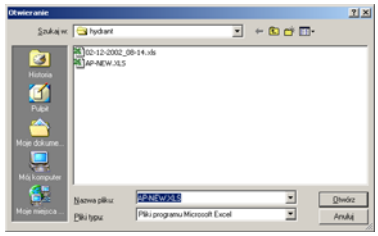


Pic. 23 Menu File.

a)"Open"

By using the Open command files with earlier created data (data import) in Excel (xls extension) or text file (csv extension) format can be loaded. We select the type of file in the "File Type" box, choosing between:





- Microsoft Excel files – xls file extension;
- Text files (data separated by tabulator characters) – csv file extension;

During the loading, the progress bar and reading operation time are visible. The application selects the directory given in config.ini file as the default. Directory change in the reading window causes a change of entries in config.ini file.

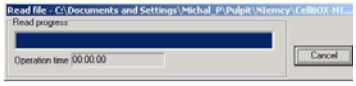
b)"Save"

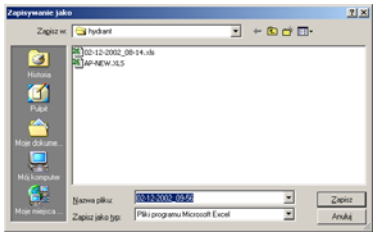
"Save" command enables to save the data read from the recorder (data export) in Excel or text file format. We select the type of file in the "File Type" box choosing between:

- Microsoft Excel files – xls file extension;
- Text files (data separated by tabulator characters) – csv file extension;

Full file name has to be given, e.g. studnia1_10-02-02.xls. or provided using suggestions of the program – name propositions consist of: *the ID of a measurement point's ID*, *date and time* separated by space characters, e.g. *H001Aleje 03-12-2002 00-16.xls*.

During the loading, the progress bar and reading operation time are visible. The application selects the

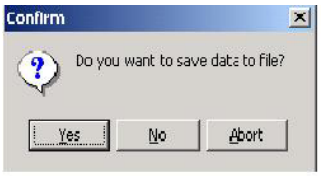




directory given in config.ini file as the default. It has to remembered that a directory change in the reading window causes a change of entries in config.ini file.

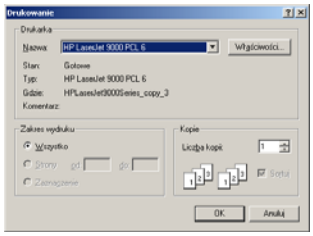
c) "Close"

The "Close" command causes deleting of the currently loaded file from the buffer memory of the application and clearing the diagram area. In case of the attempt of closing a file, which has not been saved yet (immidiately after the recorder's read) a window with the question "Do you want to save data to file?" will appear to prevent from the loss of read measurement results.



d)"Print"

"Print" command causes printing of recorded data visible on the diagram in the upper window of the application, using a printer. By using this box we can select a printer as well as configure it.



The print-out will consist of user's data ("Print-out Caption Settings" menu settings) and the diagram, in the same form as it is visible on the computer screen.

e)"Exit"

Ending of the operation of the program.

4.2.2 Menu Settings

Pic. 24 Menu Settings

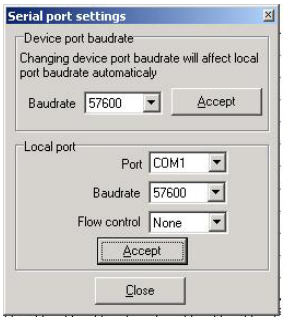
a) "Port settings"

Using this option, the computer's serial port transmission parameters are set. Default parameters for the recorder are:

- transmission speed – 57,600 bit/s,
- flow control: none,
- transmission speeds supported: 9,600. 57,600. 115,200 bit/s.

Speed of data reading from the recorder by HydraNT application can be chosen from among the three values only: 9,600, 57,600 or 115,000 bit/s (the higher the speed, the shorter the data read period) – "Speed" box.

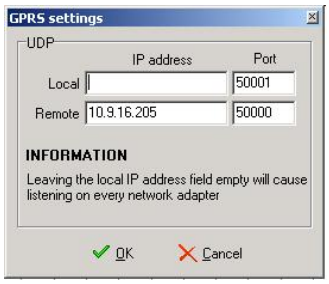
After giving the "Open port" command, the application selects the transmission parameters given in config.ini file as the default.



It has to remembered that transmission paramertes change in the "Port Settings" window causes a change of entries in config.ini file.

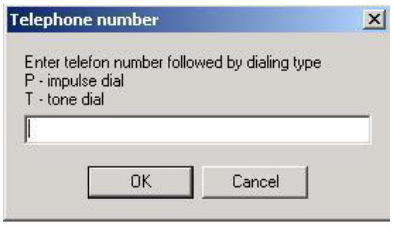
b) "GPRS Settings" (applies to working with a GPRS recorder)

We provide the IP number assigned to the SIM card installed in the recorder we are going to communicate with. Leaving an empty local IP box will cause receiving information from each network interface. Filling in this box is not necessary. Remote port number should be set to 50000 and local port number to the number of a free port in the system.



c) Modem Settings

There is an option in the program enabling to carry out the connection with CellBOX-H recorder by using an analog modem (applies to CellBOX-H operating with an external analog modem).



d) "Open Port" or "Close Port"

Before starting the configuration or reading of the content of the memory of the recorder, open the communication port and close it after finishing it. If we try to read from the recorder without opening the port, the following message will appear:

CellBOX HydraNT
Unable to open communication port.
Close applocations which may use communication port and try again
OK

"Open Port" and "Close Port" actions are accompanied with the change of the icon of the fast access button responsible for the function described above:

- port closed - port open

e) "Device Settings"

Before starting the configuration, open the communication port.

Access to the configuration window is password protected against unintentional enter.

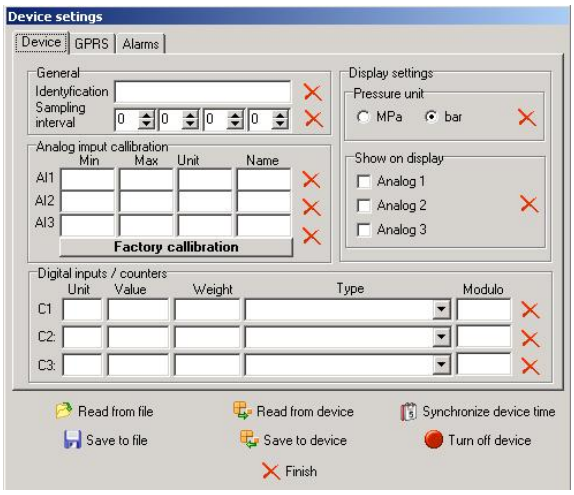
The password is given in the config.ini file at the position:

[PASSWORD]

Admin password

After giving the right password, the application automatically reads the configuration of the recorder locally or remotely connected to the computer and fills in the boxes in "Recorder", "GPRS", and "Alerts" bookmarks.

Using the first bookmark ("Recorder") the basic recorder configuration can be performed:



- provide the identifier of the measurement point (30 characters);
- set the sampling interval – it is equivalent to the period of measurement recordings to the internal memory of the recorder;
- scale the universal analog inputs individually giving the minimum value (the measured value corresponding to the 4mA signal from the converter), maximum value (the measured value corresponding to the 20mA signal from the converter), and provide the name of the unit of the measured quantity;
- specify which analog inputs will be displayed on the LCD display;
- set the type of units of pressure measurement which will be displayed on the LCD display of the recorder (bar or MPa);
- configure the digital inputs, i.e. set the type of input as event or counter type.

  Event type inputs can be not displayed or displayed, responding to a positive slope, negative slope, or both.

- Event type digital input with positive slope

Eventable - showing /

Response of a digital input in the form of sending information packs in case of changing states of pins from closed to open.

- Event type digital inputs with negative slope

Eventable - showing \

Response of a digital input in the form of sending information packs in case of changing states of pins from open to closed.

- Event type digital inputs with positive and negative slope

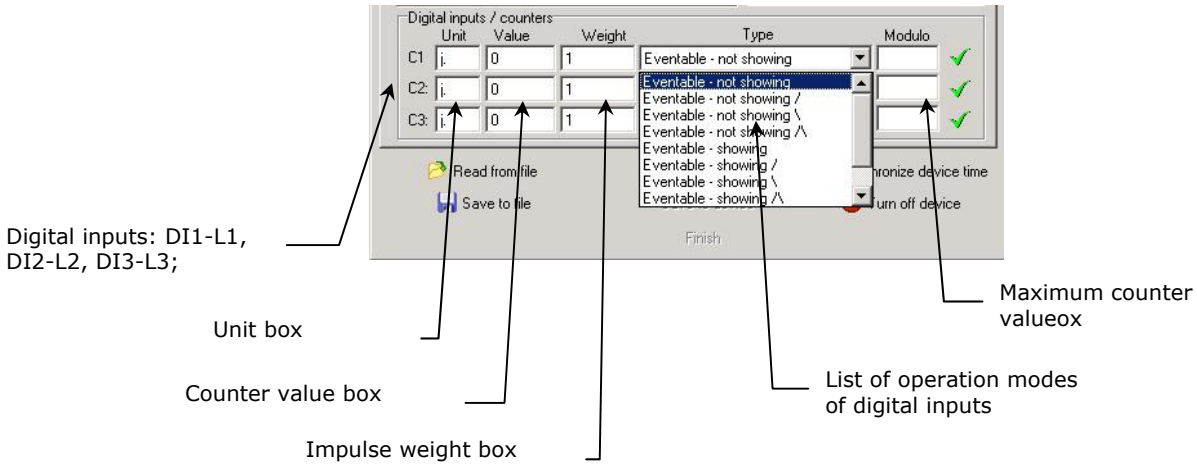
Eventable - showing /\

Response of a digital input in the form of sending information packs in case of changing states of pins from open to closed as well as from closed to open.

Set the counters value, give the impulse weight and measurement unit as well as whether the state of a given input should be displayed on the local LCD display.

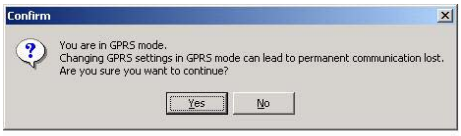
It should be remembered that when configuring the counters, if we want to measure temporary flow, the impulse weight and the start state in [m3] should be given;

- set the time (the time of the system clock of the computer will be sent to the recorder). When setting the time, pay attention to the

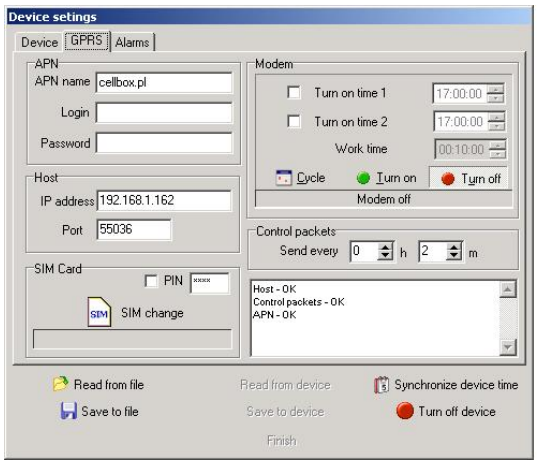


current time in the recorder and the computer, in order not to set the earlier date than the current date in the recorder by mistake, which would disturb the chronology of recorded events in the device's memory and, consequently, cause their misinterpretation later on.

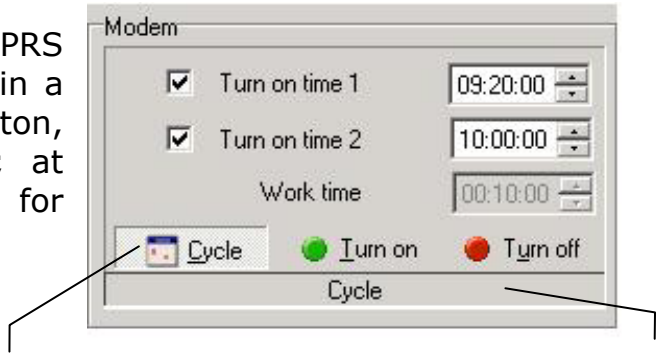
After selecting the second bookmark ("GPRS") a question concerning the further continuation of the operation appears (You are in GPRS mode.Changing GPRS settings in GPRS mode canleadto permanent communication lost. Are you sure you want to continue?). After choosing the "Yes" button, the following parameters can be provided (for the recorder with GSM/GPRS modem):


Confirm
You are in GPRS mode.
Changing GPRS settings in GPRS mode can lead to permanent communication lost.
Are you sure you want to continue?
Yes
No

- APN name (Access Point Name);
- Login and Password required by APN (optional)



- IP address of the audio computer (static IP number assigned to the SIM card installed in the GPRS modem receiving the data, e.g. in a control room), to which the measurement data from the recorder are to be sent when its modem is active during the spontaneous transmission (version option);
- Port – number of the audio computer's port;
- SIM Card pin (if it required)



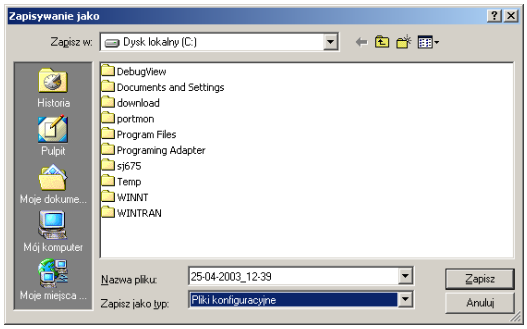
- Two different times of GPRS communication activation in a day's cycle ("Cycle" button, times of activation box); at those particular times, for about 10 minutes, it is possible to read the recorder memory, current measurements or change its configuration (this option is saved to the configuration file); It is possible to turn off the modem completely ("Deactivate" button) or turn it on for continuous operation ("Activate" button) – The "Activate" and

"Deactivate" options are not saved to the configuration file. The current time of modem operation after establishing the connection is displayed in the messages box.

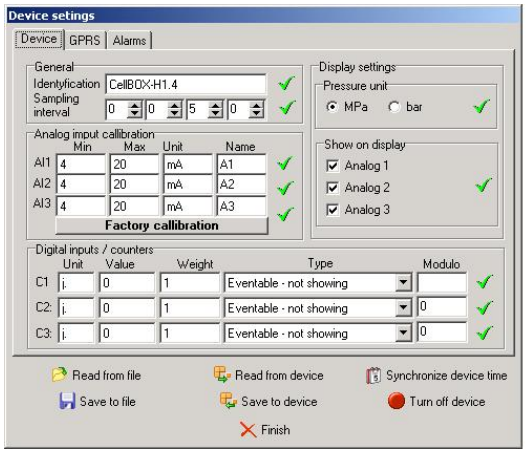
Caution: time of modem activity (10 minutes) is counted from the last data pack received from the host, which means that after finishing the reading the communication port should be closed (see Menu Settings), in order not to cause the situation of battery discharge in spite of a short activity time set. When the modem is active, the device will request to the master system via the IP number and port set each 30 seconds.

- period of sending the control pack – The recorder sends the control pack periodically under the address IP assigned by the GPRS network. If the recorder does not receive any pack confirming its presence in the system or a frame with a data request via the GPRS network, it sends another control pack at a scheduled time. After three attempts with no answer or data, the device will turn the modem off and log in to the GPRS network again. The function is activated as the default, it is recommended that the setting was not shorter than 2 minutes; Setting it to 0:0 deactivates the sending of the control pack.

The configuration can be read ("Read from the recorder" button) or saved ("Save to the recorder" button) to the recorder. The possibility of saving the settings to a file and their later reading ("Read from the file" and "Save to the file" buttons) is a useful function.



In case of setting several devices, we create a configuration profile once (a file with the configuration data) and then we save it to the recorders in sequence.



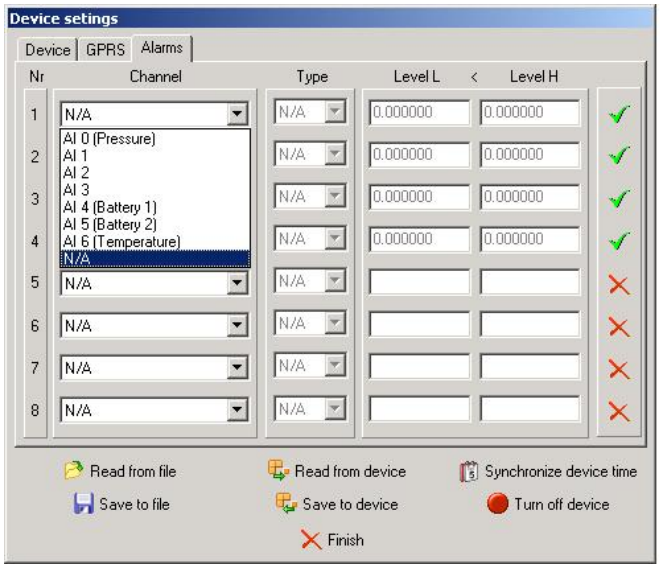
date_time.cfg

e.g. 25-04-2003_12-39.cfg

During the saving of different parameters to the device, the program controls accuracy of the data transmission. A correctly sent configuration element is signalized by the

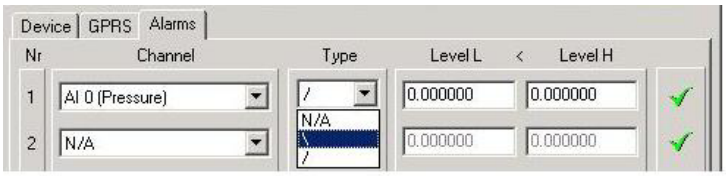
change of colour of the "signature" at the sent parameter from red to green. However, at the GPRS bookmark, the information about the correctly read or saved configuration parameter is displayed in the message window.

Using the third bookmark ("Alarms"), we perform configuration of alarms on analog inputs.



To ensure the proper operation of alert signalization of analog inputs, the following parameters must be configured:

- **"Channel"** – in this we window we choose between six analog inputs (AI0 – Pressure, AI4 – Battery1, AI5 – Battery2, AI6 – Temperature, among others) on wich we wish to set alert thresholds.

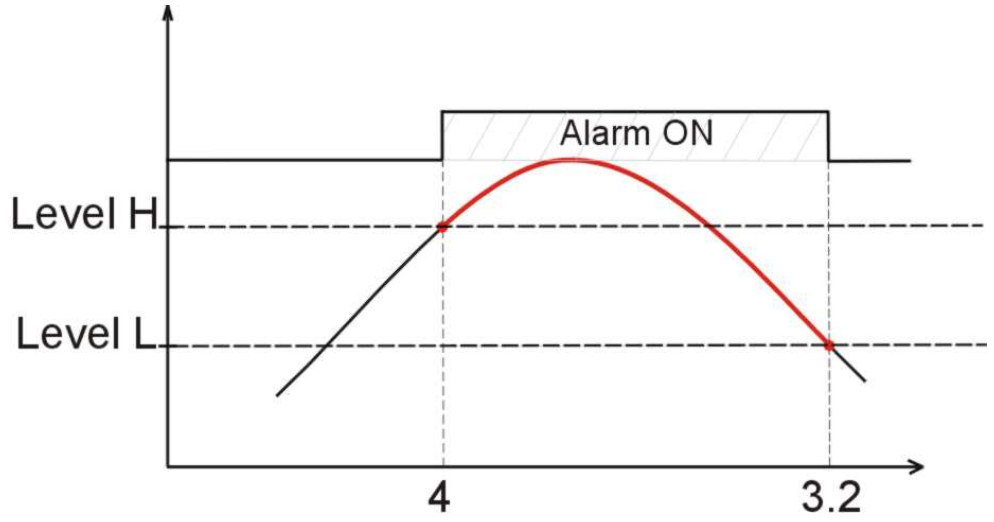


- **"Type"** – here, in the same way as in the case of digital inputs we configure the response of alerts on analog inputs. We define the response of alert thresholds to a change in any of the parameters, e.g. pressure increasingly or decreasingly.

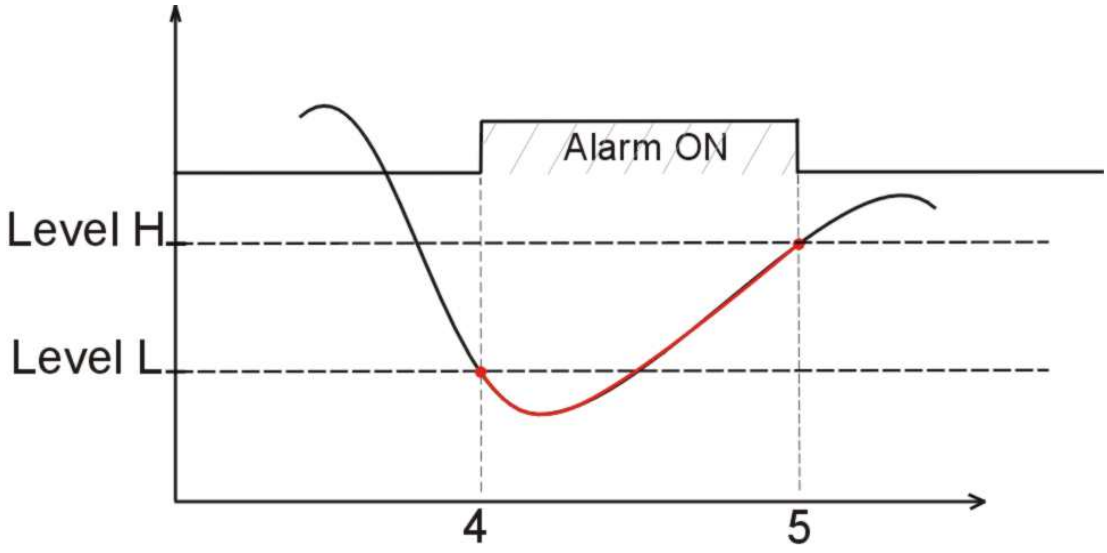
- **"Level L and Level H "** – we set the lower and upper values of alert thresholds. Exceeding one of these will be signalized with an alarm. For the alert response to a positive slope, the alarm will be launched for Level H and will last until it reaches Lavel L (Pic. 25). For the alert response to a negative slope, the alarm will be launched for Level L and will last until it reaches Level H.

When saving the configuration of analog inputs, the program signalizes a correct saving by changing the coluor of the "signature" at the sent parameter from red to green.

a)



b)



Pic. 25 Alert types: a) response to a positive slope, b) response to a negative slope.

The user can configure alert thresholds values for any analog input (maximum of 8 thresholds),

An example:

Configure 2 alert thresholds for AI0 channel (pressure) for the response to a positive slope.

- Alert thresholds should be set according to the following assumptions:

threshold Level H = 4 bar

threshold Level L = 3.2 bar

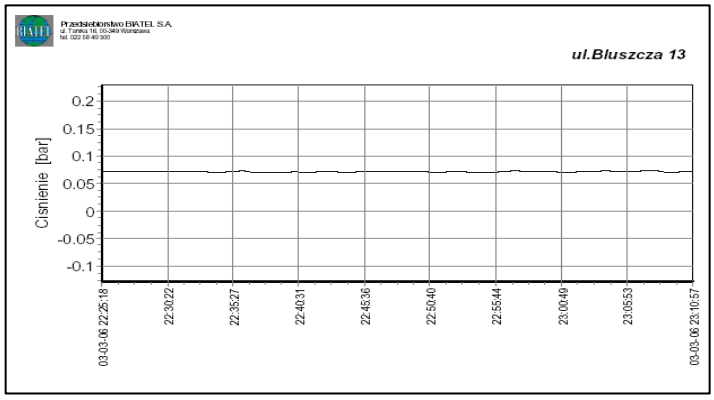
To achieve this, we enter "Device settings" and use the "Alarms" bookmark in HydraNT application (Pic. 28) where we set the number of analog input, type and two assumed thresholds Level L and Level H.

When the value of the pressure measured on a given analog input exceeds a given level defined by the user, the device will automatically enter the GPRS session and send the information packs about the alert situation to the destination point, which can be a central office. The device will be sending alert packs until it is questioned by the user's master system.

f) "Print-out Caption Settings"

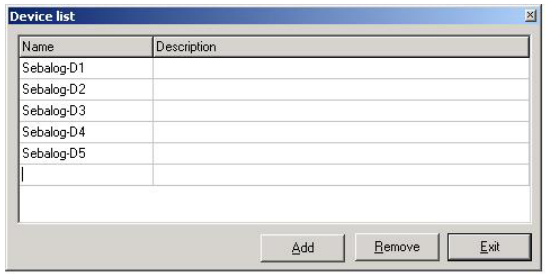
The program has the ability of printing the software user's logo and his data on diagrams (in a bitmap form). To enter this parameters, a window called from the "Print-out Caption Settings" is used.

In case of no boxes filled, a default logo is printed.



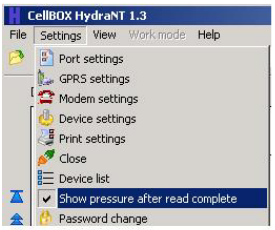
Pic. 26 An example of a print-out with data provided by the user and his logo.

g) "List of Devices"



A handy list of recorder devices, which enables an easier identification of measurements from selected sites, is stored as a help for the user. The list is created individually by the user. The entries are stored in config.ini file. During the recorder's memory read, the recorder will be added to the list provided it is not on the list yet. We can edit the list of devices by changing the contents of config.ini file or directly from the "List of Devices" window.

h) "Show the Pressure after Reading"



When selecting this option, a diagram which will open automatically after the loading of data is the diagram from pressure measurement recording. The above setting can be also done in the right verse of config.ini file, that is the box:

[SETTINGS]

Auto show=1 1-option active, 0-not active;

i) "Change of Password"

By selecting this option we can change the access password to the configuration of the recorder ("Device Settings"). Give the old password, then the new one, and confirm it. The password is present in config.ini file in the box:

[PASSWORD]

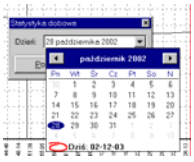
Admin password=

4.2.3 Menu View

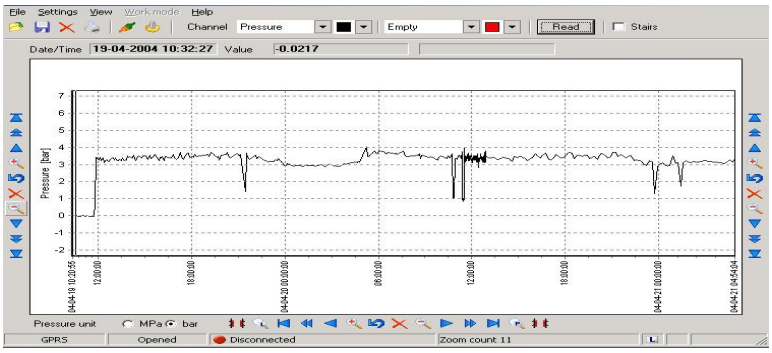
Pic. 27 Menu View.

In menu View, there are six standard formats of diagrams in terms of time available as well as the current state of the device. These diagram formats are: daily, monthly, yearly statistics, arbitrary time period, start view. Date and time on the time axis are displayed in the following format: year-month-day hour:minute:second

a) "Daily Statistics"



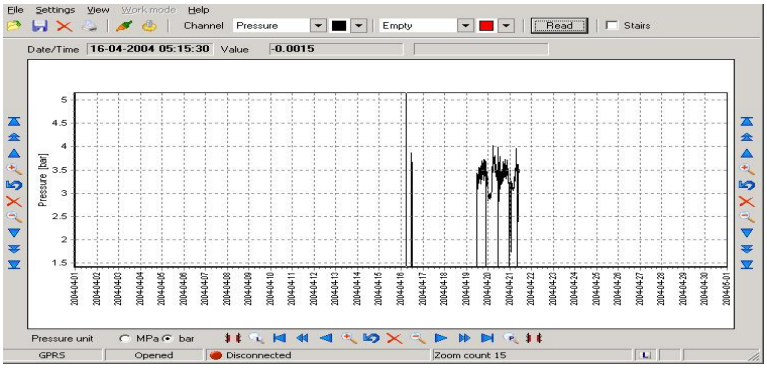
The data is formated in such a way that the basic time unit is an hour and the diagram area includes only one selected day (24-hours).


File Settings View Work mode Help
Channel Pressure Empty Read Stairs
Date/Time 19-04-2004 10:32:27 Value -0.0217
Pressure [bar]
Pressure unit MPa bar
GPRS Opened Disconnected Zoom count 11

Pic. 28 Daily statistics

b) "Monthly Statistics"

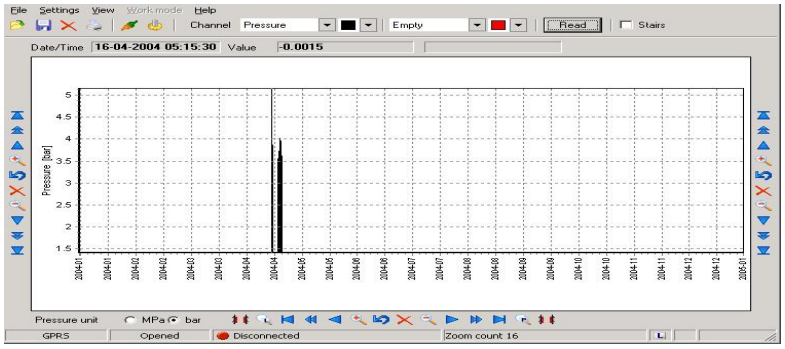
The data is formated in such a way that the basic time unit is a day (24 hours) and the diagram area includes only one selected month.


File Settings View Work mode Help
Channel Pressure Empty Read Stairs
Date/Time 16-04-2004 05:15:30 Value -0.0015
Pressure [bar]
Pressure unit MPa bar
GPRS Opened Disconnected Zoom count 15

Pic. 29 Monthly statistics

c) "Yearly Statistics"

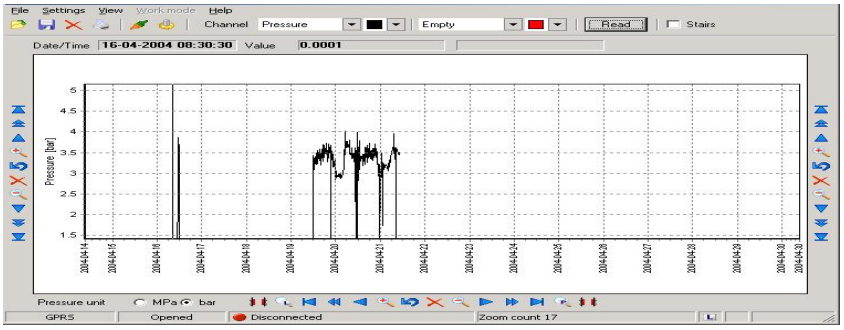
The data is formated in such a way that the basic time unit is a month and the diagram area includes only one selected year.


File Settings View Work mode Help
Channel Pressure Empty Read Stairs
Date/Time 16-04-2004 05:15:30 Value -0.0015
Pressure [bar]
Pressure unit MPa bar
GPRS Opened Disconnected Zoom count 16

Pic. 30 Yearly statistics

d) "Arbitrary Time Period"

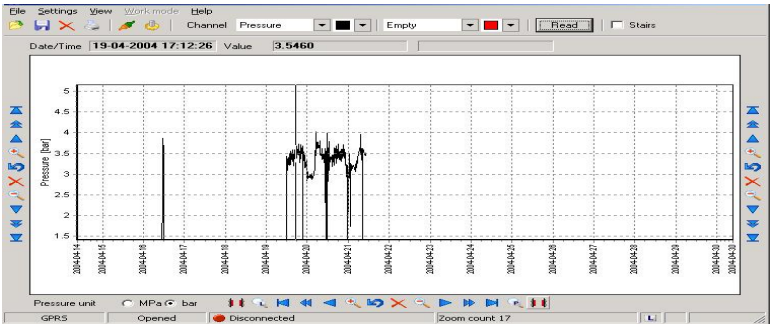
The data is formated in such a way that the diagram area includes all data from a given time period, and the time scale division is formated automatically. The program remembers the last setting of time period during its operation, so we can view the data from the same period from different measurement points.


File Settings View Work mode Help
Channel Pressure Empty Read Stairs
Date/Time 16-04-2004 08:30:30 Value 0.0001
Pressure [bar]
Pressure unit MPa bar
GPRS Opened Disconnected Zoom count 17

Pic. 31 Statistics in a selected time period.

e) "Start View"

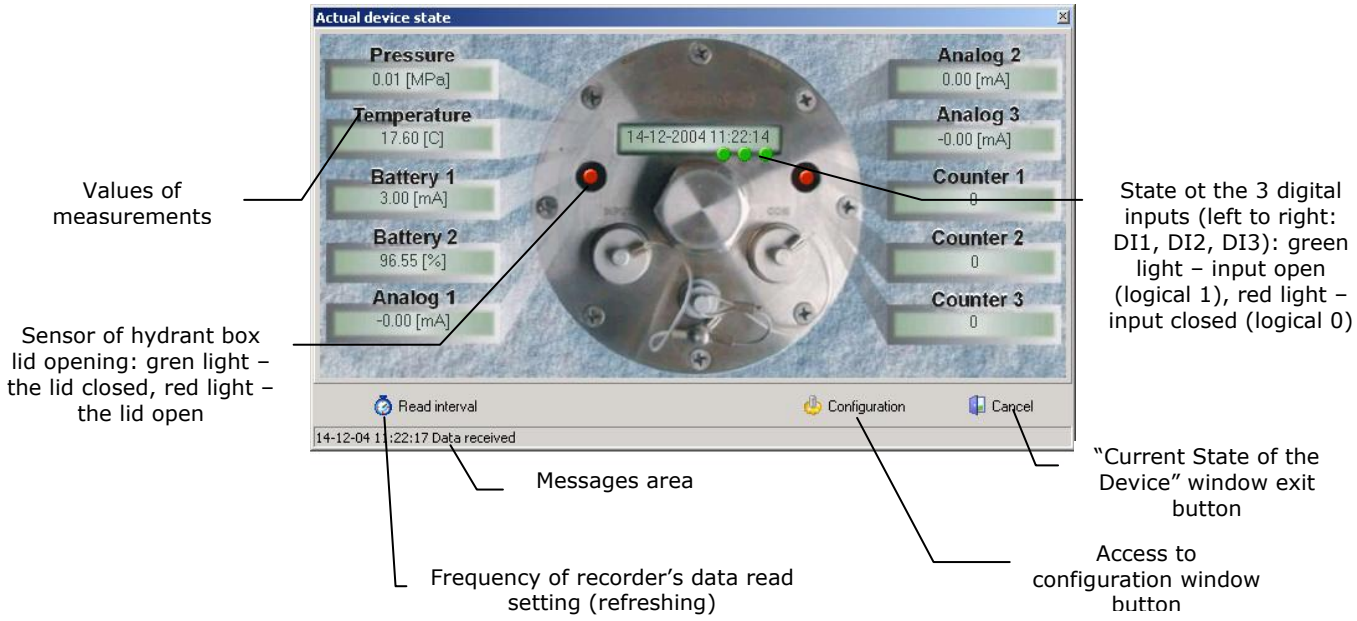
The data is formated in such a way that the diagram area includes all data and the time scale is formated automatically. All formating operations are deleted and the default format, the same as the one at the time of loading the data, is restored.


File Settings View Work mode Help
Channel Pressure Empty Read Stairs
Date/Time 19-04-2004 17:12:26 Value 3.5460
Pressure [bar]
Pressure unit MPa bar
GPRS Opened Disconnected Zoom count 17

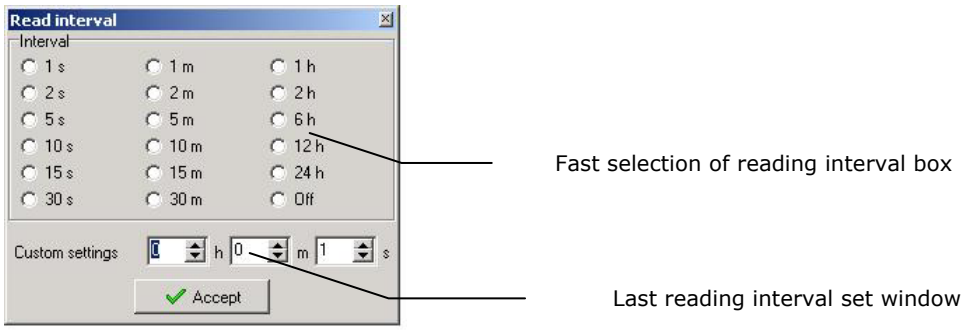
Pic. 32 An example of statistics in "Start View" format

f) "Current State of the Device"

To view the current state of the device, the communication channel must be earlier configured and opened. Data transfer between the application and the recorder can be achieved via the local RS232 port or the GPRS network. The window content is refreshed periodically according to the reading frequency set ("Reading Frequency" button). From the "Current State of the Device" window level we can also configure the recorder ("Configuration" button) in the same way as it has been described in pt. 4.2.2e "Device Settings".

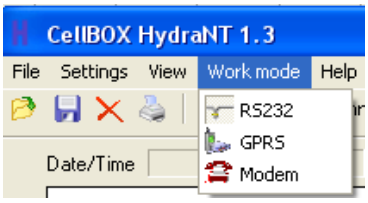


Pic. 33 "Current State of the Device" window.



Pic 34 Window of setting the interval of measurements from the recorder (period of refreshing information from the device).

4.2.4 Menu Work Mode



Pic 35. Menu Work Mode.

We have 3 modes of operation of the application with the computer at disposal:

- Communication with the recorder via the local port of the computer;
- Communication with the recorder via a GPRS network (a recorder with the GPRS option required, connection with the GPRS network in the computer HydraNT application will operate on, e.g. GPRS modem connection of Dial-Up type and the current activity of the modem of the recorder we wish to establish connection with). GPRS operation parameters are saved in config.ini file in boxes:

[GPRS]

Local IP=

Remote IP=10.0.0.3

Local Port=50033

Remote Port=50000

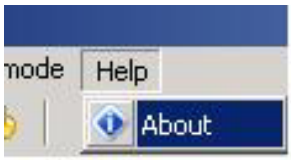
Interval=20 (interval between two successive questions in [s])

Retries=20; (number of question repetitions for GPRS transmission disturbances)

- Communication with the recorder via an analog modem.
  The program has an option enabling estabilishing the connection with CellBOX-H recorder using an external analog modem (it applies co-operation of CellBOX-H with an analog modem; a telephone modem connection between the computer and the recorder is required).

The application chooses the operation mode given in config.ini file as the default. Remember that the change of mode causes an automatic change of config.ini file entries. We can change the mode only when the communication port is closed, otherwise "Mode of Operation" menu is unavailable.

4.2.5 Menu Help



Pic. 36 Menu Help

a) "Help"

Opening of the file with the help concerning software operation and functioning of the device (a study).

b) "About the program"

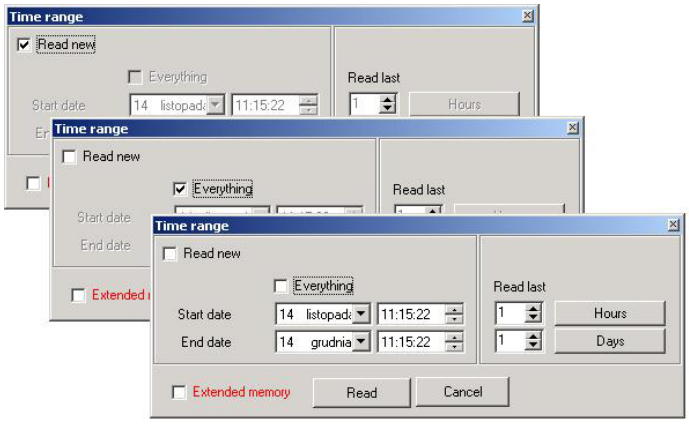
4.3 Reading of the memory content of the recorder

We can read the recorder's memory content from the main window of the application.

To do it, configure the correct mode of the device and communication port parameters (RS232 local port or GPRS) and open it (4.2.2. Menu Settings).

After opening the communication port, the status of the selected port will appear in the messages box, e.g.:

(if the communication with the device is correct) a light should start to flash (red-green colour) and beside it the time from the recorder should be displayed. Remember that, if the communication channel is open, the data between the software and the computer is continuously exchanged (internal time of the device read).

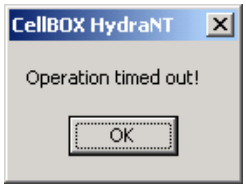


Selecting the Read command ("Read" button) effects in appearing of the selection window with the following time periods:

- period from the last reading to the present moment;
- selected time period (the program suggests the actual date as the final date as the default);
- whole memory content;

The option of taking date from the last reading to the present moment appears as the default, it has the purpose of automatization of the proccess of collecting subsequent recorded measurement sessions in the situation when the recorder operates in the same place all the time and periodical readings from the device are necessary. During the reading

of the memory content, a progress bar and the reading operation time appear. In case of the lack of the correct communication with the device, the program will report the following message:



When GPRS is used, remember about synchronizing the reading time the moment the GSM/GPRS modem in CellBOX-H is turned on.

When we change the place of installation of CellBOX-H, it is recommended to note the installation time of the recorder or performing the initial reading in the new place immidiately after the installation. By doing so, we avoid the situation whereby the data from the previous and present places of the recorder's instalation is taken (in case of selecting "Read from the date of the last reding to the present moment" option).

Due to the amount of data the recorder can collect, the time for a complete memory read can amount to a few to a dozen or so minutes.

Access to the reading window is possible after pressing the Enter key.

Caution: For data reading via the GPRS, it should be remembered that the data transmission speed is about 9600 bit/s, therefore in order not to discharge the internal batteries or external accumulator excessively, it is recommended to take data from the last 24-hour period (with sampling period of 15 minutes or more).

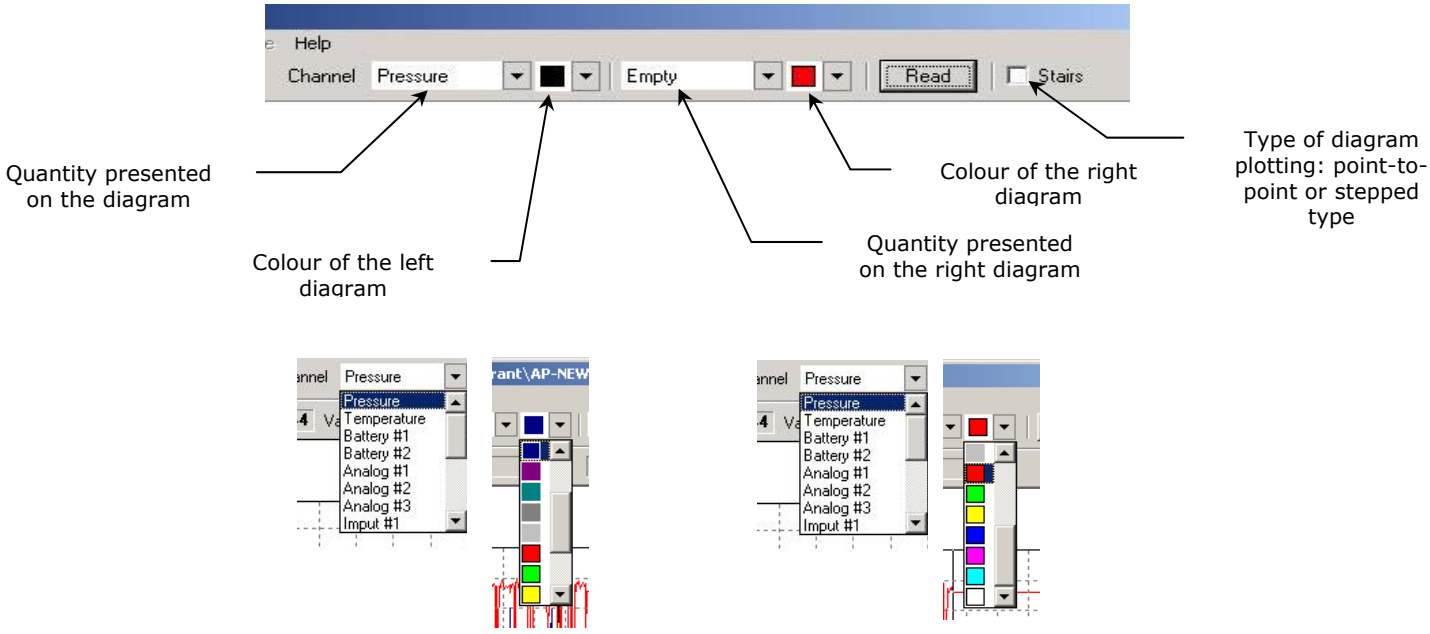
4.4 Graphical presentation of measurement results

The program enables a simultaneous presentation of two quantities, originating from the recording for a selected location of the recorder on a common time scale. Data that has to be presented on the diagram is chosen from the two expandable lists ("Measured quantity") placed underneath the diagram area. We can choose from the following elements (types of diagrams):

- Pressure;
- Temperature;

- Battery #1 (state of useful voltage of the internal batteries – microproccessor power supply);
- Battery #2 (state of useful voltage of the internal batteries – measurement systems power supply);
- Analog #1 (additional analog input AI1);
- Analog #2 (additional analog input AI2);
- Analog #3 (additional analog input AI3);
- Input #1 (state of additional digital input DI1);
- Input #2 (state of additional digital input DI2);
- Input #3 (state of additional digital input DI3);
- Counter #1 (state of the counter assigned to the digital input DI1);
- Counter #2 (state of the counter assigned to the digital input DI2);
- Counter #3 (state of the counter assigned to the digital input DI3);
- Counter #1 increasingly (increment of state of the counter assigned to the digital input DI1 related to the internal memory write period);
- Counter #2 increasingly (increment of state of the counter assigned to the digital input DI2 related to the internal memory write period);
- Counter #3 increasingly (increment of state of the counter assigned to the digital input DI3 related to the internal memory write period);
- None (not displayed).

Additionally, the colour of the diagram can be chosen (default: left diagram – black, right – red). The scales of the diagram are taken from config.ini file.

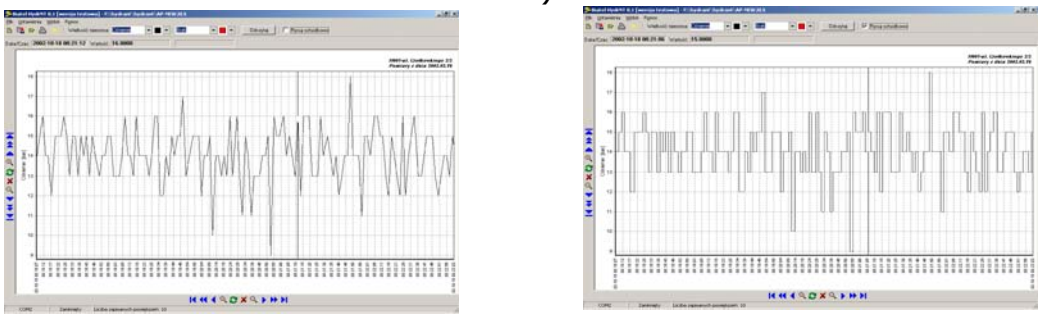


a) b)

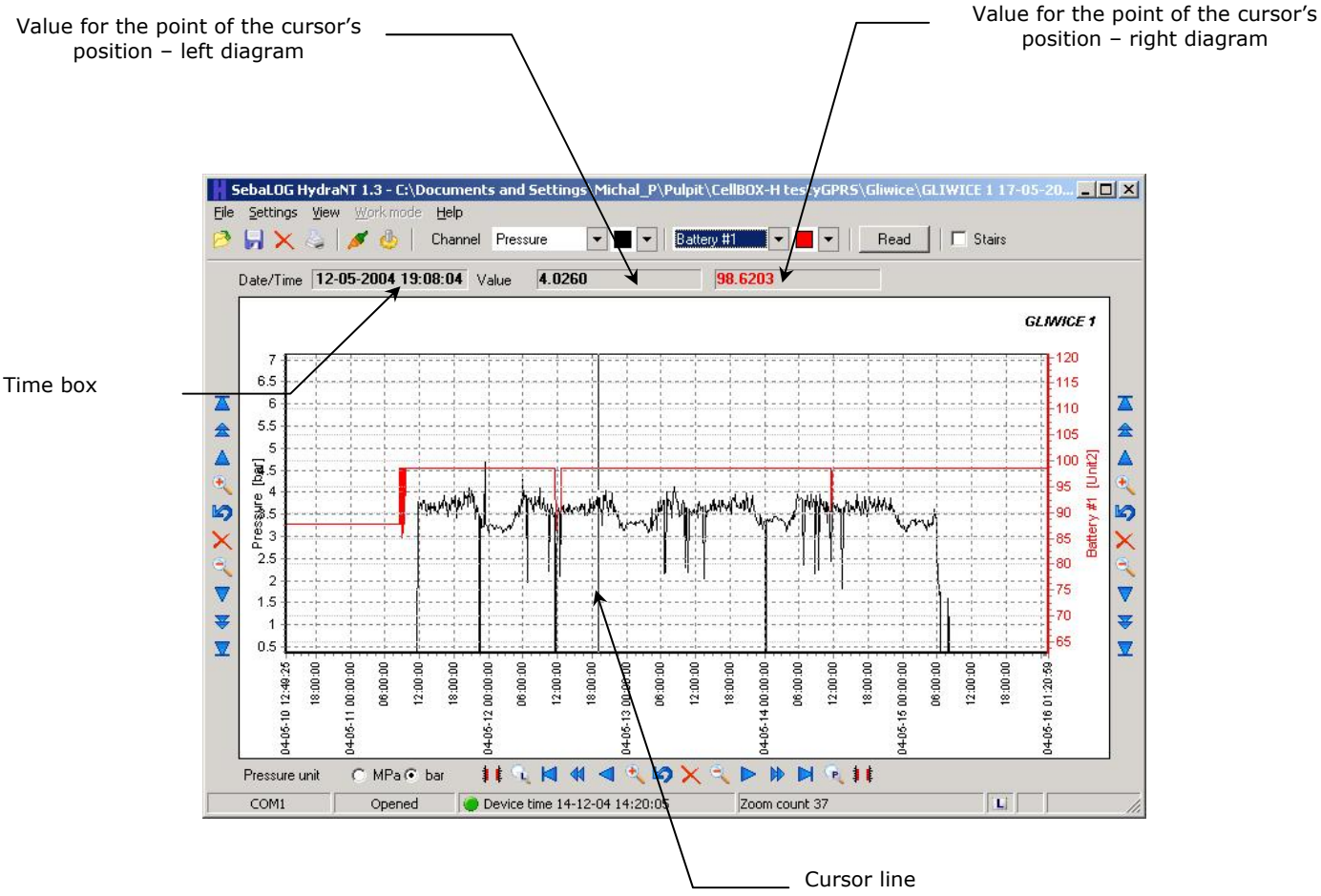
Pic. 37 Selection of the diagram a) left diagram b) right diagram.

Diagram plotting can be done using point-to-point method or stepped plotting method, where each sample is a separate "step".

a) b)

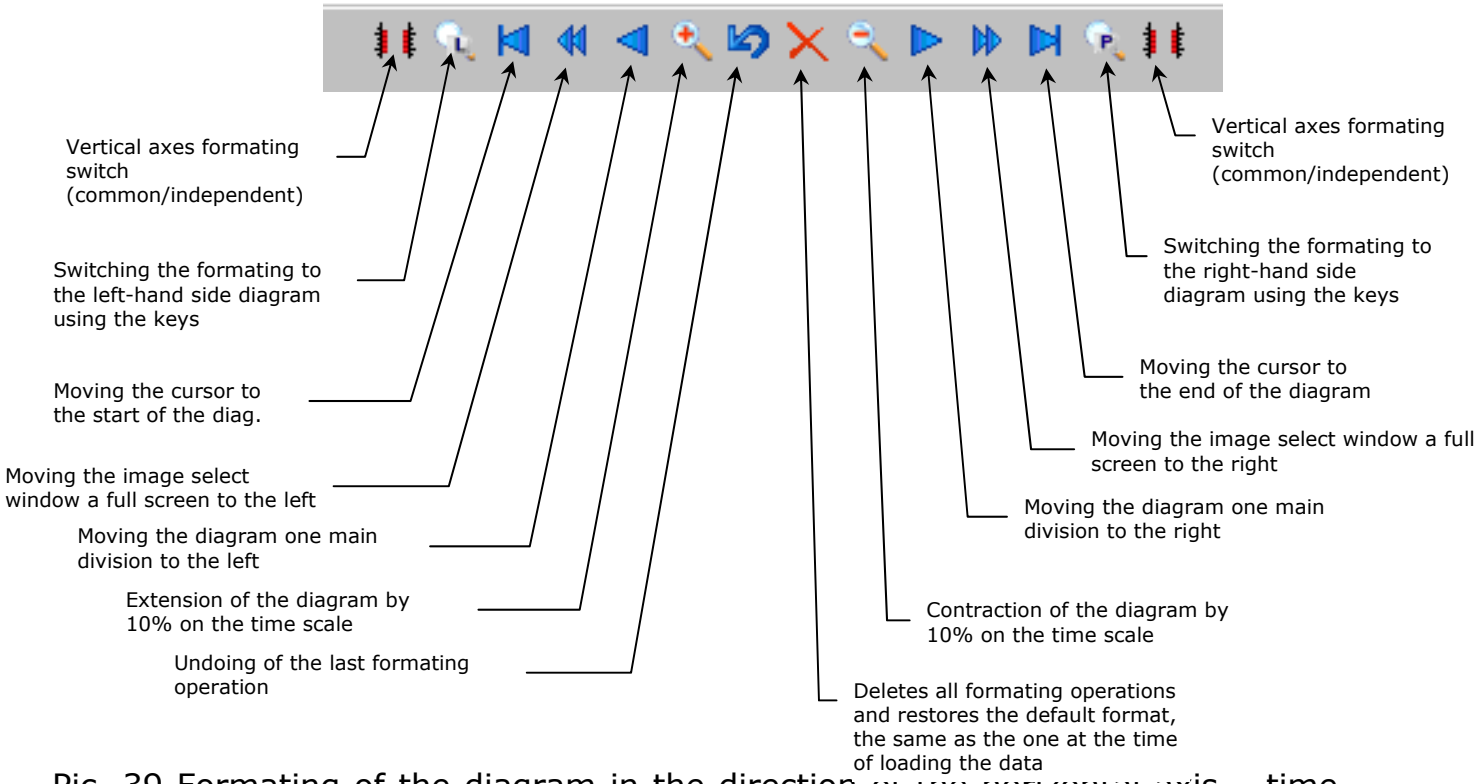


Pic. 38 Methods of diagram plotting a) point-to-point b) stepped


Value for the point of the cursor's position – left diagram
Value for the point of the cursor's position – right diagram
Time box
Cursor line
SebaLOG HydraNT 1.3 - C:\Documents and Settings\Michal_P\Pulpit\CellBOX-H tes\yGPRS\Gliwice\GLIWICE 1 17-05-20...
File Settings View Work mode Help
Channel Pressure Battery #1 Read Stairs
Date/Time 12-05-2004 19:08:04 Value 4.0260 98.6203
GLIWICE 1
Pressure [bar]
Battery #1 [Unit2]
Pressure unit MPa bar
COM1 Opened Device time 14-12-04 14:20:05 Zoom count 37

A cursor is used for the diagram navigation (a vertical line). The current position of the cursor is displayed in the windows at the top of the main window. To zoom in a fragment of the diagram, hold the left Ctrl and left-clicking the mouse select the area of the diagram to be zoomed in. To move the diagram, hold the left Ctrl and right-clicking the mouse move the diagram in the desired direction.

For a fast formating of the diagram in the direction of the horizontal and vertical axes we use buttons at the bottom of the diagram (horizontal x-axis formating) and on the left and right-hand side (vertical y-axis formating – left or right).


Vertical axes formating switch (common/independent)
Switching the formating to the left-hand side diagram using the keys
Moving the cursor to the start of the diag.
Moving the image select window a full screen to the left
Moving the diagram one main division to the left
Extension of the diagram by 10% on the time scale
Undoing of the last formating operation
Deletes all formating operations and restores the default format, the same as the one at the time of loading the data
Contraction of the diagram by 10% on the time scale
Moving the diagram one main division to the right
Moving the image select window a full screen to the right
Moving the cursor to the end of the diagram
Switching the formating to the right-hand side diagram using the keys
Vertical axes formating switch (common/independent)

Pic. 39 Formating of the diagram in the direction of the horizontal axis – time axis

Each pressing of the vertical axes formating switch button causes switching between common (the right axis formatting buttons will be hidden) and independent formating (formating buttons of both vertical axes are available). The choice of formating is signalized by the change of the icon visible on the button:

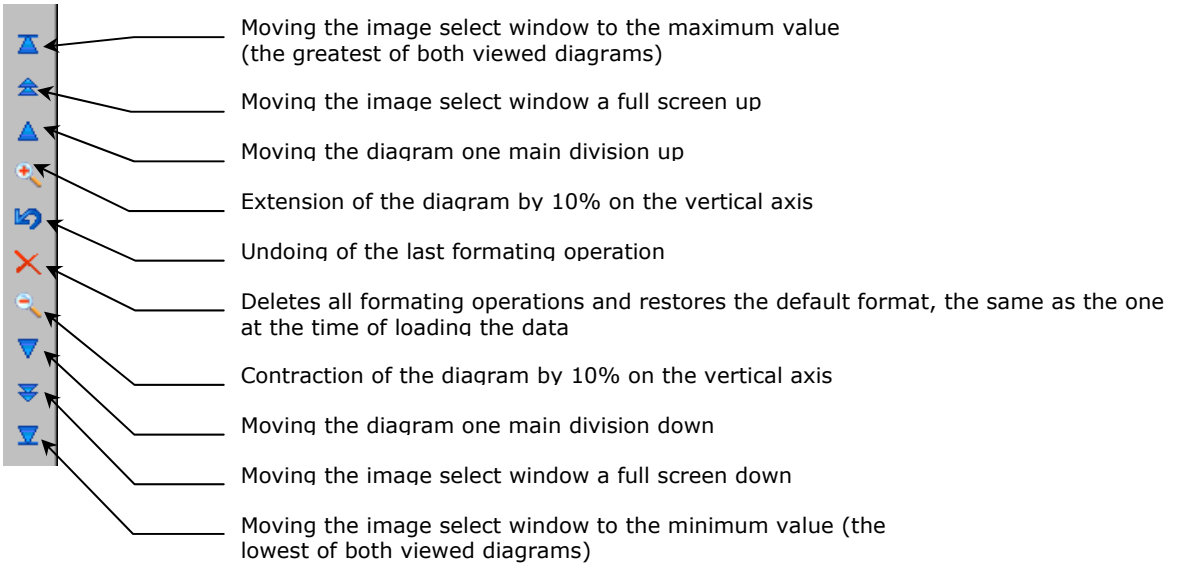
- common formating of both vertical axes

- independent formating of each vertical axis

Switching of formating to the left or right-hand side diagram using the keys is accompanied by the change in the message box:

- formating the left diagram using numerical keyboard keys

- formating the right diagram using numerical keyboard keys


Moving the image select window to the maximum value (the greatest of both viewed diagrams)
Moving the image select window a full screen up
Moving the diagram one main division up
Extension of the diagram by 10% on the vertical axis
Undoing of the last formating operation
Deletes all formating operations and restores the default format, the same as the one at the time of loading the data
Contraction of the diagram by 10% on the vertical axis
Moving the diagram one main division down
Moving the image select window a full screen down
Moving the image select window to the minimum value (the lowest of both viewed diagrams)

Pic. 40 Formating of the diagram in the direction of the vertical axis – values axis

The program also enables fast formating of the diagram area using the following numerical keyboard keys:

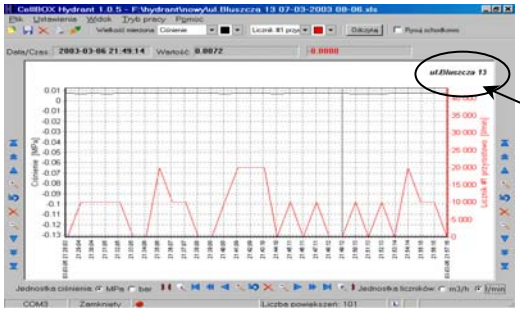
Description of a numerical keybord key	Function performed
↑ **8**	Moving the diagram one main division up
↓ **2**	Moving the diagram one main division down
← **4**	Moving the diagram one main division to the left
→ **6**	Moving the diagram one main division to the right
HOME 7	Moving the image select window a full screen up
END 1	Moving the image select window a full screen down
Ins 0	Moving the image select window a full screen to the left
Del.	Moving the image select window a full screen to the right

5	Undoing of the last formating operation
/	Contraction of the diagram by 10% on the time scale
*****	Extension of the diagram by 10% on the time scale
-	Contraction of the diagram by 10% on the vertical axis
+	Extension of the diagram by 10% on the vertical axis

Other keyboard shortcuts:

Keys combination description:	Function performed
Ctrl + l	Switching the edtition from numerical keys to the left-hand side diagram
Ctrl + p	Switching the edtition from numerical keys to the right-hand side diagram
Ctrl + o	Vertical axes formating switch (common/independent)
Enter	Calling the function of data read from the recorder
Ctrl + left mouse button	Selecting the diagram window to zoom in
Ctrl + right mouse button	Moving the image select window
Alt + p	Calling the Menu *File*
Alt + u	Calling the Menu *Settings*
Alt + w	Calling the Menu *View*
Alt + t	Calling the Menu *Mode of Operation*
Alt + p	Calling the Menu *Help*
Alt + left mouse button	Calling the window of entering the diagram annotation

We can change or give a title for the viewed part of the diagram. To do it, right-click the mouse in the upper-right corner of the diagram area. The measurement point identifier is the default title.



A dialogue window will appear, where two boxes: Title and Description have to be filled in or changed.

Additionally, we can place our own annotations on the diagram, which will be visible on the print-out. To do it, place the mouse cursor in the position where the annotation will be placed and press the following keys combination: Alt + left mouse button. A dialogue window will appear, where the box "Enter the annotation text" should be filled in.

The current software version do not have the option of edition of the annotation entered, only its deletion by placing the cursor on it and right-clicking the mouse and then the button confirming the deletion.

Pressure and "Counter #... increasingly" diagrams

demand a more detailed description.

a) Pressure diagram

The pressure diagram can be scaled only in [bar] or [MPa] units. The default unit is given in the config.ini file (0.Unit parameter). To change the pressure unit between [bar] and [MPa], two buttons are used: MPa and bar.

Buttons for selecting the pressure unit are visible if pressure is presented on any of the diagrams.

b) "Counter #... increasingly" diagram

This diagram is created on the basis of the following relationship:

$$\frac{counter_1 - counter_0}{record\_time_1 - record\_time_0}$$

Where:

$Counter_0$ – state of the counter at the preceding moment → $record\_time_0$

$Counter_1$ – state of the counter at the present moment → $record\_time_1$

The current software vrsion allows to present the above relationship as a temporary flow. **The diagram can be scaled only in the units of [m3/h] or [l/min].** The default unit is given in the config.ini file. To change the flow unit between [m3/h] and [l/min], two buttons are used: "m3/h" and "l/min".

The buttons for selecting a unit are visible if Counter #... increasingly (flow) is presented on any of the diagrams.

Start states of the counters and impulse weights must be expressed in [m3] in the recorder's configuration to ensure that the diagrams present the real measurements.

4.5 Working with data

To transfer recording results between computers, the data read from the recorder should be exported to a file in Excel format or a text file (if we do not save the recording results to a file after reading from CellBOX-H recorder, the data visible in HydraNT application window will be lost after the application is closed). HydraNT application in the dialogue window concerning saving suggests the default directory (the directory given in the config.ini file, parameter Data=.....), name and the type of file.

To read the saved data and subject it to statistical processing, load it from the already existing file. See, Menu File description, pt. 4.2.1.

In order not to lose the read data in case of accidental closing of the program, the application asks the user whether to save the data, which is directly in its memory.

Text files (data separated by tabulator character) can also be loaded to a spreadsheet. In case of Microsoft Excel, use the option of external data import (Data/Download external data/Import text file menu, and then select the box 'with separators' and choose Tabulator as a separator).

Data exported to an Excel format file is formated in three sheets:

a) READOUTS

Each column consists of successive recorded measurements. Column titles descriptions mean:

NR - number of successive sample;
TOM – time of measurement;
PV - pressure value;
TEMP - temperature value;
BAT1 - % value of useful voltage of battery 1;
BAT2 - % value of useful voltage of battery 2;
AI1 - value of the analog signal on the AI1 input;
AI2 - value of the analog signal on the AI2 input;
AI3 - value of the analog signal on the AI3 input;
DI0 - state of digital input DI0;

DI1 - state of digital input DI1;

DI2 - state of digital input DI2;

C1 - counter operating on DI0 input;

C2 - counter operating on DI1 input;

C3 - counter operating on DI2 input;

CNTEV - code of event – given as a decimal number;

REASON - code of the reason for an event recording – given as a decimal number;

Meaning of individual bits of the code for binary notation:

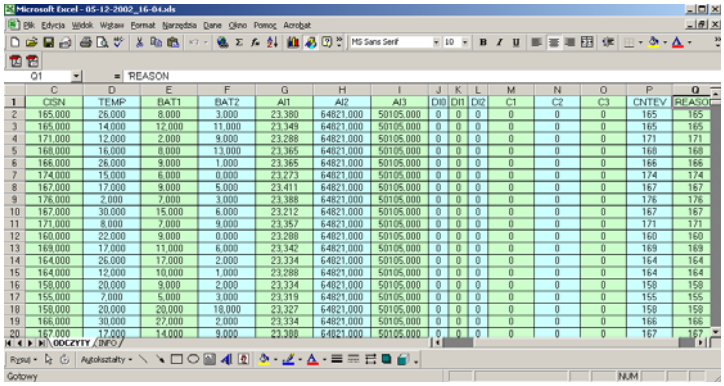
mes_done - BIT0
mes_AI0 - BIT1
mes_AI1 - BIT2
mes_AI2 - BIT3
mes_AI3 - BIT4
mes_VbatLoHi - BIT5
ev_DI0_ON - BIT6
ev_DI0_OFF - BIT7
ev_DI1_ON - BIT8
ev_DI1_OFF - BIT9
ev_DI2_ON - BIT10
ev_DI2_OFF - BIT11
ev_opto_ON - BIT12
ev_opto_OFF - BIT13
ev_wired_ON - BIT14
ev_wired_OFF - BIT15

b) INFO

Consists of two columns: NAME (measurement point identifier) and INFORMATION (description).

c) ANNOTATION

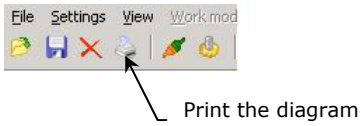
Cansists of the content of the annotation and the x,y position on the diagram it refers to.



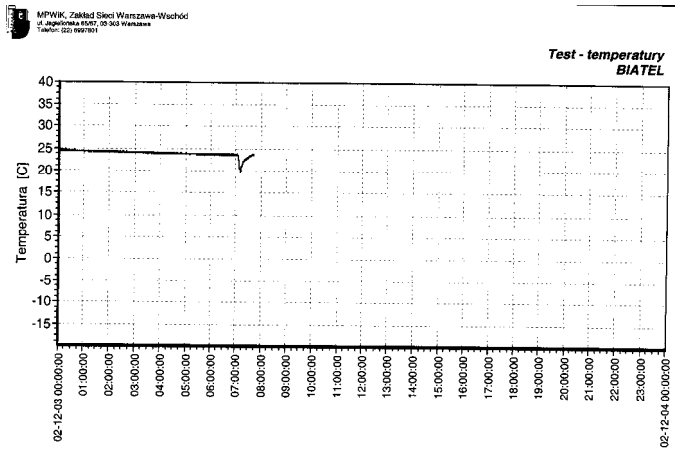
Pic. 41 An example of the content of the archive file in Excel format

4.6 Print-outs

To print a viewed diagram, choose the print option from the menu File or use the Print icon.



The diagram is printed in the same graphical form as it is seen on the computer screen and, additionally, an information box about the customer who bought the software will be appended in the upper left corner ("Print-out Caption Settings" in Menu Settings should be filled in).



Pic. 42 An exampe of a print-out

4.7 Configuration of default parameters of HydraNT application

Default parameters concerning the application operation and diagram formating are given in config.ini flie.

Units of measurement displayed as a description of vertical axes are taken from the internal settings of the recorder. In case of not providing a unit to the internal memory of the device, the names of units of measurement will be loaded from config.ini file.

An example content of config.ini file:

```
[PORT SETTINGS]  - transmission parametres
Communication mode=0
Port=COM2
Baud Rate=57600
Flow Control=None

[LOGO]                - content of information box about the user of the software
Bitmap=D:\ARCHIWUM\Logo.bmp
Title#1=BIATEL S.A. Joint-Stock Company
Title#2=ul. Tamka 16, 00-349 Warszawa
Title#3=tel. 022 58 49 300

[SETTINGS]            - whether the pressure diagram should be printed automatically after
                        loading of the data
Auto show=1           0-NO, 1-YES
Interval=10000

[PASSWORD]            - access password to the configuration window
Admin password=biatel

[DIRECTORIES]         - directories where data and recorders' configurations are to be stored
Config=c:\config      - configuration directory
Data= c:\data         - directory with data read from the recorders

[DEVICES]             - list of recorders defined by the user
Europa=Biatel  S.A.   – name = description
Neo= ul. Ciołkowskiego

[CHART SETTINGS] – settings of range of scaling and units
0.Auto=0              - Auto=0 – automatic scaling off
0.Min=0.0             - minimum scale value of the vertical axis
0.Max=20.00           - maximum scale value of the vertical axis
0.Unit=bar            - unit
1.Auto=1              - Auto=1 – automatic scaling on
1.Min=-20
```

1.Max=40.00
1.Unit=C
2.Auto=1
2.Min=4.0
(...)
15.Auto=0
15.Min=0
15.Max=2000
15.Unit=m3/h

[GPRS] – Communication settings via GPRS network
Local IP=
Remote IP=100.100.1.122
Local Port=50001
Remote Port=50000
Interval=10

Numbering of parametres in config.ini file corresponds to the following measured quantities:

0 - Pressure;
1 - Temperature;
2 - Battery #1;
3 - Battery #2;
4 - Analog #1
5 - Analog #2
6 - Analog #3
7 - Input #1
8 - Input #2
9 - Input #3
10 - Counter #1
11 - Counter #2
12 - Counter #3
13 - Counter #1 increasingly
14 - Counter #2 increasingly
15 - Counter #3 increasingly

5. For Advanced Users – Service Commands.

6. Additional Accesories.

6.1. External accumulator packs.

6.2. Chargers and buffer type power supplies.

6.3. Internal battery packs.

6.4. Cables and connectors.

6.5. GSM antennas.

6.6. GSM modems.

7. User’s notes.